THE AMERICAN RADIO RELAY LEAGUE, INC.
INTERNATIONAL SECRETARIAT OF THE INTERNATIONAL AMATEUR RADIO UNION
ADMINISTRATIVE HEADQUARTERS NEWINGTON, CONNECTICUT, U.S.A. 06111

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JAMES E. McCOBB
K1LLU, TREASURER
203-666-1541
QST
OFFICIAL JOURNAL

April 2, 1987

AD HOC COMMITTEE ON AMATEUR RADIO DIGITAL COMMUNICATION

Gentlemen:

MEETING NOTICE

There will be a meeting of the Digital Committee on Saturday, May 23, and Sunday, May 24, 1987, at ARRL HQ.

A number of issues of accumulated, and others have intensified, since our most-recent meeting. Here is a preliminary agenda:

1. Completion of packet frequency recommendations

Minute 80: On motion of Mr. Haynie, seconded by Mr. Stafford, it was VOTED that the Membership Services Committee deliver its recommendations on the packet band plan as per Minutes 45a and 45h of the 1986 Annual Meeting no later than the July 1987 Board meeting.

(Recall that we developed some frequency recommendations and passed them to the Membership Services Committee. See my letter of June 20, 1986 and the attached minutes of our June 14-15, meeting which included results of our study of packet-radio frequencies. We need to reaffirm what we already covered and include recommendations for bands not previously studied. Our recommendations then need to go to the Membership Services Committee prior to the July Board meeting.)

2. Facilitate message handling via packet radio

Minute 71: Moved, that the Committee on Amateur Radio Digital Communication be charged to develop for Board ratification a proposal for facilitating NTS message handling (both regular and emergency), plus ancillary amateur-to-amateur message and data traffic via packet radio. The investigation should consider changes in message formats, system software or any other area which may be necessary to achieve the objectives. The Committee should incorporate the concepts developed by the Blue Ribbon Committee, Emergency Communications Advisory Committee, National Traffic System Area Staffs and providers/creators of existing software and hardware. The Committee is directed to report to the Board no later than the 1988 Annual Meeting.

(The above minute highlights message-transfer protocols, and we should consider forming a subcommittee to examine present NTS message formats, the WØRLI message autoforwarding protocol, the CCITT X.400 message protocol suite and any other models. However, the issues are far broader and impact on packet-radio network development, NTS, ECAC, SKIPNET, etc. The Board voted $17,000 for the Digital Committee to fund for any necessary meetings with the SKIPNET principal stations and NTS staffs during 1987 to make the right things happen. It appears that this would be possible later this year upon completion of our homework.)

3. STA for HF automatic control

(The draft of a letter to the FCC requesting an STA for automatic control of HF packet stations was approved by the Executive Committee at their March 21, 1987 meeting. The next step is for HQ to advise the stations involved and obtain signed letters of participation. Thereafter, we can send the letter to the FCC. Those actions should be completed by our May 23-24 meeting. In any event, we should review this subject.)

4. Networking and transport protocols

(See Enclosure B, which gives the status of the four current protocol implementations. Is it possible for us to agree on a course of action, or will the market place decide?)

5. Sixth Computer Networking Conference preparations

6. Updating AX.25 link-layer protocol

(One or two problems have emerged, which may suggest minor changes to the Version 2.0 protocol. Also, Terry Fox has had SDL diagrams "90% done" for quite sometime. Could we also consider whether it is feasible to handle longer call signs such as FP7/WB4JFI or NNNØAAA?)

7. AMSAT Phase 4 engineering plans

(Jon Bloom and I will attend the AMSAT Phase 4 engineering conference at Boulder, April 4-6, and will brief the committee on digital matters.)

8. Progress on =>9.6-kbit/s modems (ARRL lab & commercial)

9. Impact of Novice Enhancement on packet planning

ACTION: By April 17, please let me have:

o whether or not you will attend May 23-24,

o arrival/departure for hotel booking purposes, (try to get here by Friday evening and leave Sunday evening), and

o any suggested additional agenda items.

Please book flights well in advance to obtain the lowest rates. Also, any use of rental cars for which you want reimbursement will need prior coordination with me.

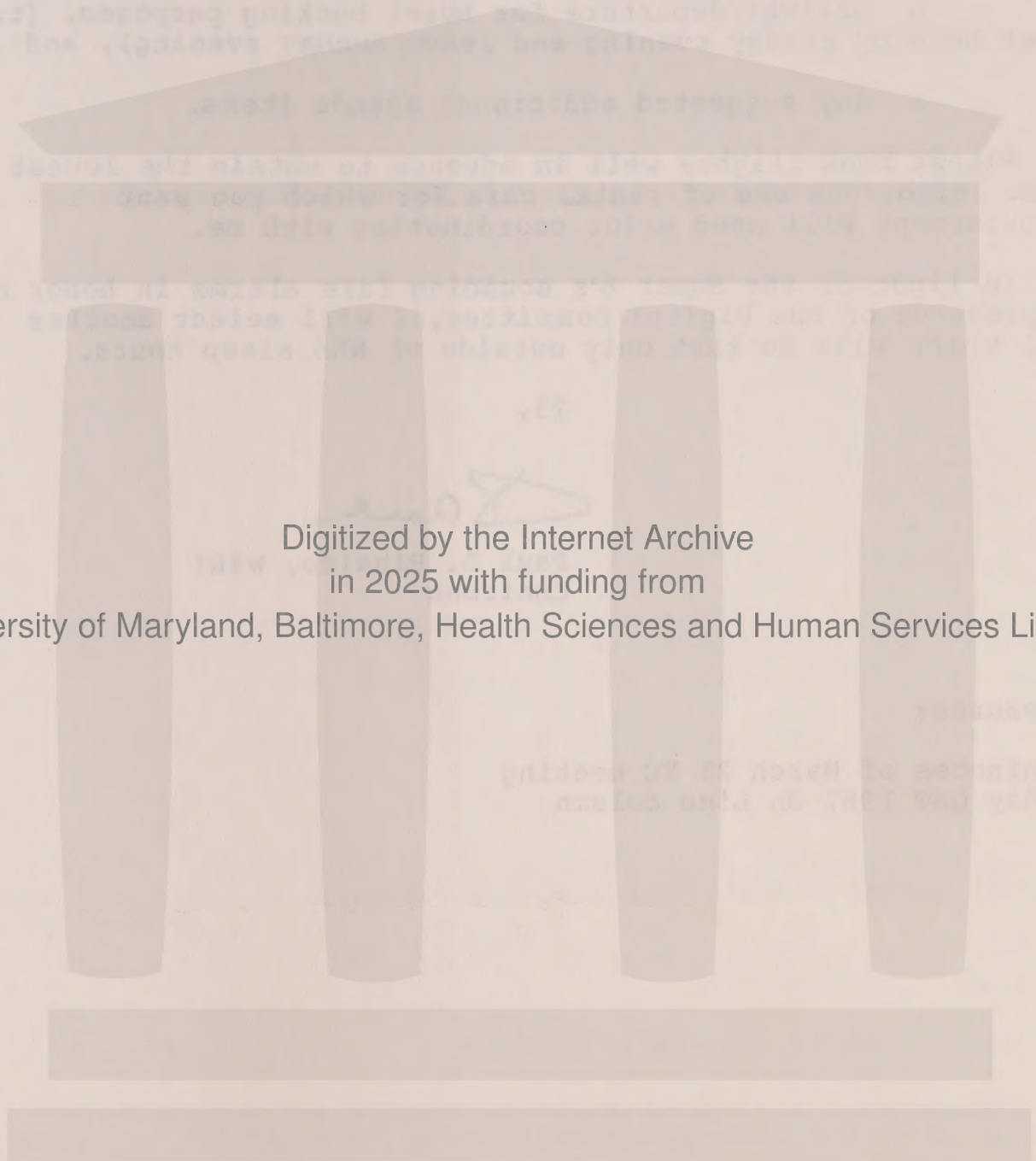
In light of the Super 8's sounding fire alarms in honor of the presence of the Digital Committee, I will select another hotel which will do that only outside of REM sleep hours.

73,

Paul L. Rinaldo, W4RI
Chairman

Enclosures:

A. Minutes of March 21 EC meeting
B. May QST 1987 On Line column



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Moved and Seconded . . .

Minutes of Executive Committee
No. 425
New Orleans, Louisiana
March 21, 1987

AGENDA

1. Approval of Minutes of August 23, 1986 meeting.
2. Ratification of mail votes of December 12, 1986 and March 5, 1987.
3. Studies requested of the Executive Committee by the Board:
3.1 Regarding Article 9, votes required for adoption of amendments, requested by Minute 79, July 1986 Meeting.
3.2 Regarding the procedures used in evaluating qualifications of candidates in ARRL director/vice director elections, Minute 81, 1987 Annual Meeting.
4. FCC Matters:
4.1 Consideration of ARRL action regarding General Docket 87-14, Amendment of Part 2 of the Commission's Rules Regarding the Allocation of the 216-225 MHz band.
4.2 Consideration of ARRL Response to the FCC inquiry in PRB-3, Privatization of Special Call Sign System.
4.3 Consideration of the timing with respect to Board-requested filing (Minute 103, January 1986) reference to amendment of Section 97.313. of the Commission's rules to provide for reverse-order reciprocal call signs.
4.4 Review of draft request for special temporary authorizations for automatic control of HF packet.
5. Consideration of an ARRL position toward HR 911, the Volunteer Protection Act of 1987.
6. Consideration of an ARRL position toward proposed IRS rules regarding lobbying by nonprofit organizations.
7. Local antenna/RFI matters.
8. Review of progress on Board directives:
8.1 By the vice presidents and/or chairmen for the committees.
8.2 By the Executive Vice President, on Board directives affecting Headquarters.
8.3 By the Executive Vice President, on the proposed Visitors' Center.
9. Recognition of new Life Members.
10. Affiliation of clubs.
11. Convention matters:
11.1 Approval of division, state and section conventions.
11.2 National Convention matters.
12. Date and place of next meeting.
13. Other business.

Pursuant to due notice, the Executive Committee of the American Radio Relay League met at 8:30 AM, Central Standard Time, Saturday, March 21, 1987, at the Westin Canal Place Hotel in New Orleans, Louisiana. Present were President Larry E. Price, W4RA, in the Chair; First Vice President Jay A. Holladay, W6EJJ; Executive Vice President David Sumner, K1ZZ; Directors Frank M. Butler, Jr., W4RH; Clyde Hurlbert, W5CH; Paul Grauer, WØFIR; and George S. Wilson, III, W4OYI. Also present were Vice Presidents Leonard M. Nathanson, W8RC and Tod Olson, KØTO; Secretary Perry Williams, W1UED; Counsel Christopher D. Imlay, N3AKD; and Directors Tom Frenaye, K1KI; Jim Haynie, WB5JBP; Fried Heyn, WA6WZO; Stephen A. Mendelsohn, WA2DHF; and Edmond A. Metzger, W9PRN.

1) On motion of Mr. Wilson, the Minutes of the August 23, 1986 meeting were adopted as printed.

2) On motion of Mr. Wilson, the mail votes of December 12, 1986 and March 5, 1987 were ratified.

3) Studies requested by the Board:

3.1) As concerns the number of votes required for adoption of amendments under Article 9, ARRL Articles of Association, Mr. Price reviewed the history of the Article, last amended in 1966. Since that time, the president reported, no difficulty with the Article was apparent, nor could record be found of member dissatisfaction with the present rule. After further discussion, on motion of Mr. Grauer, it was decided to advise the Board that no change was required in By-Law 9 save for deletion of the reference to "air mail," a class of service no longer provided domestically.

3.2) With regard to a study of procedures used in evaluating the eligibility of candidates for election to the offices of director and vice director, as requested in Minute 81 of the January 1987 Board Meeting, Mr. Price reported preoccupation with the release of three major matters by the FCC in the past several weeks had precluded proper preparation for study at this meeting. Whereupon, it was ruled without objection that the matter is carried forward to a future meeting.

4) FCC Matters:

4.1) As concerns General Docket 87-14 which would amend Part 2 of the FCC Rules, so as to reallocate the frequencies 220-222 MHz to the government and non-government Land Mobile services, after extended discussion on motion of Mr. Butler it was unanimously decided:

To reaffirm the ARRL's long-standing position that the Amateur Radio service needs the entire 220-225 MHz band in order to perform its public-interest missions;

To set defense of this allocation as the ARRL's highest priority;

To muster every available resource for this task;

To accept the kind offer of the Canadian Radio Relay League that it file its own independently drawn Comments to the FCC, supporting the preservation of 220-225 MHz as a primary amateur allocation; and

To ratify wholeheartedly the officer/staff actions already taken in response to General Docket 87-14.

4.2) Moving next to consideration of the FCC inquiry in PRB-3, Privatization of Special Call Sign System, the President reported that he had assigned studies on various aspects of the matter to special and standing committees.

4.2.1) Messrs. Butler and Wilson, the members of the Special Committee, presented a report, "Conditions Under Which The ARRL Could Support Privatization of the Call Sign Program." There ensued an extended discussion and "fine tuning" of the paper. On motion of Mr. Butler, the amended Special Committee Report was accepted; Mr. Wilson requested to be recorded as desiring retention of a deleted statement: "FCC must not charge additional fees for licensing activity." The majority held that the words were not relevant to the call sign question. During the course of the above discussion, the Executive Committee was in recess from 10:30 to 10:56 AM and, for luncheon, from 11:53 AM to 12:57 PM.

4.2.2) Mr. Metzger, as chairman, reported for the Administration and Finance Committee, on appropriate fees and startup expenditures for a Special Call Sign Coordinator (SCSC) program. The committee recommended that the Commission rather than the SCSC is the proper body to announce the program, should it come into being, by a mailing to all amateurs.

4.2.3) On motion of Mr. Wilson, the following action was unanimously adopted:

"Considering the complexities of the issues presented, and uncertainty as to the effectiveness of the ultimate result in view of the apparent inadvertent omissions in Federal Register publication of PRB-3, and considering the apparent misconceptions in the amateur community as to the possible impact of the program, Counsel is directed to seek an extension of time for filing until July 31, 1987."

4.3) The Executive Committee next considered the timing of a request for rulemaking to adopt reverse-order reciprocal call signs. The request had been authorized at Minute 103 of the January 1986 Board Meeting. Later, the Executive Committee delayed the matter until certain points were cleared up. After discussion, the consensus was there were no remaining obstacles to submission of the request to the FCC; Counsel could proceed at will.

4.4) At this point the Committee reviewed a draft of a request for Special Temporary Authorization (STA). Under the STA, 19 stations specifically listed in the application would be permitted to operate HF packet nodes under automatic control at speeds up to 1200 bauds to perform a controlled study of HF packet networks. (The final outcome of PR Docket 85-105 last year was to allow automatic packet operations above 50 MHz but not on the HF or MF bands. However, the way was left open for an STA leading to such a study.) The Interim Operations Plan for Skipnet, on which the STAs will be based, was carefully drawn up over the past year so as to include all the HF packet pioneers who requested to participate. After discussion, on motion of Mr. Wilson, it was agreed to file the application for a one-year special temporary authorization as outlined.

5) After consideration of HR 911, the Volunteer Protection Act of 1987, the Executive Committee took no action on the bill in its present form. Staff will monitor its progress; should certain deficiencies perceived in the measure be corrected, the ARRL could adopt a position at a later date.

6) On motion of Mr. Grauer, the Committee went unanimously on record as opposing draft rules of the Internal Revenue Service which could inhibit lobbying on issues of importance to amateurs.

7) Counsel Imlay reported on several local antenna and Radio Frequency Interference matters.

8) Review of progress on Board directives:

8.1) By the vice-presidents and/or chairmen for the committees:

8.1.1) Mr. Holladay reported that the post-Board meeting of the Membership Services Committee would be held at Visalia, California on April 3, 1987. The similar meeting of the Special Study Committee on Advisory Committees had not yet been scheduled.

8.1.2) For the Legal Strategy Committee, its chairman Mr. Nathanson reported an organized attack on restrictive covenants; a planned continuing education course for volunteer counsel in connection with the National Convention in Atlanta on July 11-12, 1987; and a planned meeting of the LSC at that time. A consensus was reached that *QST* editorial mention of local antenna cases should not imply ARRL endorsement of local fund-raising activities in support of these amateurs.

8.1.3) Mr. Olson reported that the Publications Committee would meet in Newington on March 28, 1987.

8.1.4) The Administration and Finance Committee met March 14-15, 1987 at Orlando, Florida. Mr. Metzger, as its chairman, presented its Minutes, including discussion of the forthcoming video, New World of Amateur Radio under the direction of Roy Neal, K6DUE, formerly of NBC; several internal administrative matters; and the financial side of PRB-3, as reported above.

8.1.5) Mr. Frenaye, as Secretary, reported for the Volunteer Resources Committee; its first meeting of 1987 will be April 26 in Dayton, Ohio.

8.2) The Executive Vice President presented a chart, "1987 Annual Board Meeting Action Items," and answered questions from the group on items therein. At its conclusion, the Committee was in recess from 2:35 to 2:55 PM.

8.3) Mr. Sumner also presented the progress report on the Visitors' Center. Dr. Owen Garriott, W5LFL, former astronaut who was "the first amateur in space" has agreed to serve as chairman of a committee to advise on exhibit planning for the proposed ARRL Visitors' Center. A lot of work has been done on the funding plan, now nearing completion. Some possible names for the Visitors' Center, slogans, and elements of a campaign logo were discussed though not finalized.

9) On motion of Mr. Grauer, the names of 39 newly elected Life Members were recognized, and the Executive Vice President was directed to list their names in *QST*.

10) On motion of Mr. Butler, the following clubs were declared affiliated, all in category I except where indicated:
Chestnut Ridge Radio Club, Teaneck, NJ
Harrison Amateur Radio Club, Cadiz, OH
Hilltop Amateur Mastertie System, Marina del Rey, CA

(continued on page 74)

Tri-County Tri-Banders, Pennington, NJ
Turkey Island DX Club, Ottumwa, IA
Upper Kittitas County Amateur Radio Club, Cle Elum, WA

With the election of these clubs, the League has 1682 clubs in Category I, 14 in Category II, and 123 in Category III.

11) Convention matters:

11.1) There followed a discussion of coming conventions. On motion of Mr. Hurlbert, established policies regarding state conventions and regarding conflicts in dates with the ARRL National Convention were unanimously reaffirmed. Whereupon, on motion of Mr. Wilson, the following conventions meeting these policies were approved:

North Florida Section, August 1-2, 1987, Jacksonville FL
Northwestern Division, August 22-23, 1987, Tacoma, WA
Great Lakes Division, August 29-30, 1987, Saginaw, MI
Virginia State, October 3-4, 1987, Virginia Beach, VA
Kansas State, October 10-11, 1987, Wichita, KS
Tennessee State, October 24-25, 1987, Chattanooga, TN
South Florida Section, November 20-22, 1987, St. Petersburg, FL
Southwestern Division, September 2-4, 1988, Anaheim, CA
Southeastern Division, November 18-20, 1988, Tampa, FL

11.2) Mr. Butler reported briefly regarding the program for the ARRL National Convention in Atlanta, GA, July 11-12, 1987; without objection, the plans were approved. As a matter of collateral information, it was reported that the ARRL 1987 Second Board Meeting will be held July 9-10 in the Westin Peachtree Plaza Hotel, near the Georgia World Congress Center.

12) The Executive Committee will meet next on call of the President.

13) Other business:

13.1) On motion of Mr. Grauer, a nominee for the office of Honorary Vice President was unanimously found to meet the criteria for that office set forth in the Standing Orders, and the nomination was ordered forwarded to the Board for consideration at the 1988 Annual Meeting.

13.2) On motion of Mr. Wilson, the Committee wholeheartedly commended all members of the Hq. staff who had played a role in production of the April issue of *QST*, particularly as concerns covering the 220 MHz matter and Novice Enhancement (Applause).

13.3) The Secretary reported that the first ARRL Humanitarian Award given posthumously to Victor C. Clark, W4KFC, would be presented to Hester Clark, WA4PAE, at the annual banquet sponsored by the Vic Clark and Washington Chapters, Quarter Century Wireless Association, at the Key Bridge Marriott Hotel, Rosslyn, VA on March 28, 1987 (Applause).

There being no further business, on motion of Mr. Holladay, the meeting adjourned at 5:00 PM.

Respectfully Submitted:
Perry Williams, W1UED
Secretary

Life Members Elected
March 21, 1987

Rodney C. Adams, KA1OUJ; Jane A. Allen, KA5JVF; Dan Amoroso, KA3MNF; Brad Anbro, KA9LTR; Avery C. Baswell, Jr, W4MQK; Robert E. Bishop, KB7GJ; Norma J. Bollinger, NC3X; Robert S. Bollinger, NC3T; John Breazeale, N2EXR; Robert J. Byers, WA6D; Blaine Caudill; WA4EIC; William M. Colony, KA7KLH; John M. Ciullo, N1ID; Jack W. Forbes, WB6QDC; David R. A. Horn, KK5I; James Kerr, N8GHP; Alan Lim, WB6BMD; Toni A. Nessen, N6GYI; Robert M. O'Connell, NF2Z; Michael H. O'Marah, KA7MUL; Charles H. Otnott, III, WD5BJT; William A. Painter, WA4QCH; Howard L. Pomeroy; James W. Rutten NWØD; Robert Savoy, KK3V; Alan B. Smith, KA5VUL; Louise F. Smith, N5HBI; Willis K. Smith, WD4CHP; Kenneth D. Stein, KD2WG; Alan Terrell, N4KGT; Mark Van Hooser, WBØFNA; Alan R. Viegas; Gedas G. Vysniauskas, WD8BYA; Frederick V. Weir, W2UB; M. Ybarra, KG6DU; Kathleen Willfong, KB6ONI; James L. Willfong, II, WB4AYE; M. S. Young, KG9T; Stephen R. Zumbrun, W6SHO.

Moved & Seconded

(continued from page 57)

Houston Amateur Mobile Society, Houston, TX
Iberville Repeater Assn., Inc., Plaquemine, LA
La Porte Amateur Radio Club, La Porte, IN
Lewis & Clark Radio Club, Godfrey, IL
Liberty County Emergency Communications Amateur Radio Club, Hinesville, GA
Long Island Contest Club, Deer Park, NY
Maryland Apple Dumpling Radio Amateur Radio Society, Wheaton, MD
North Ottawa Amateur Radio Club, Ferrysburg, MI
Orrville Amateur Radio Society, Orrville, OH
Packet and Repeater Klub, Libby, MT
Peninsula Amateur Radio Club, Long Beach, WA
Potter Junior High School Amateur Radio Club, Fallbrook, CA (Category III)
Public Safety Amateur Radio, Jackson, MS
Quaboag Valley Amateur Radio Club, Wheelwright, MA
San Benito Amateur Radio Club, San Benito, TX
Schaumburg UHF Amateur Repeater Society, Ringwood, IL
Serious Hams Amateur Radio Club, Pensacola, FL
Spa Amateur Radio Association, Hot Springs, AR

On Line

Conducted By Stan Horzepa, WA1LOU
75 Kreger Dr, Wolcott, CT 06716
CompuServe ID no. 70645,247

Packet-Radio Networking Leaps Forward

For several years the concepts of higher-level protocols have been discussed within the packet community. At present, a packet user must specify all the routing information required to get a packet from point A to point B. A network-layer implementation handles the routing for the user. Let's look at some of the network implementations under consideration.

NET/ROM

The W6AMT network of digipeaters in California is testing a new firmware program for the TNC 2. Called "NET/ROM," the new firmware supports networking capabilities (commonly referred to in packet-radio circles as "layer three" and "layer four").

Developed by Ron Raikes, WA8DED, and Mike Busch, W6IXU, of Software 2000, Inc, NET/ROM runs on a standard TAPR TNC 2 terminal-node controller, or on any of the commercially available TNC 2 "clones." NET/ROM is distributed in the form of a 27C256 EPROM, which simply plugs into the ROM socket of the TNC 2 in place of the standard TAPR firmware ROM. NET/ROM is intended for use primarily at wide-coverage digipeater sites. It is not appropriate for end-user or mailbox stations.

A NET/ROM node provides the normal functions of an ordinary AX.25 digipeater, plus a set of sophisticated higher-level networking capabilities. A NET/ROM node user may display a list of other known network nodes; establish a transport-level circuit to a distant node; and connect to another end-user or mailbox in the vicinity of the distant node. Compared with conventional AX.25 multihop digipeating, NET/ROM's true store-and-forward packet switching technology can provide an order-of-magnitude improvement in throughput, especially over long paths. Routing from the local node to the distant node is handled automatically, and even includes alternate routing to circumvent network outages.

NET.EXE

Another approach to the implementation of higher-level protocols is that taken by Phil Karn, KA9Q, in his NET.EXE program for the IBM PC. Essentially, Phil argues that there is no need to tie ourselves down to the AX.25 link layer protocol when a layer-four (transport) protocol is operating to ensure end-to-end data integrity. Phil's approach, as embodied in his NET.EXE program, allows several possible link-layer protocols (including AX.25).

NET.EXE executes the Defense Advanced Research Projects Agency (DARPA) suite of protocols. Included in these are IP, the Internet Protocol; TCP, the Transmission Control Protocol; ARP, the Address Resolution Protocol; FTP, the File Transfer Protocol; and SMTP, the Simple Mail Transfer Protocol. All of these are above the link layer in the hierarchy of protocols. At the link layer, NET.EXE supports simple serial data transfer via SLIP, the Serial Line Interface Protocol, and nonprotocol serial I/O.

One of the most interesting aspects of the NET.EXE system is that it can do more than one job concurrently. TCP, which is used to provide end-to-end data integrity, can support multiple connections. NET.EXE also supports multiple applications processes. Using the multiconnect protocols, you could, for example, initiate a file transfer to another computer using FTP, and while that transfer is taking place you can chat with the operator of the remote computer using TELNET (the terminal-to-terminal "chat" protocol). Or perhaps chat with the operator of a *different* remote computer. Or receive forwarded mail. Or receive a file. Or...(You get the idea.)

TEXNET

This networking protocol uses datagrams with node-to-node acknowledgments. User selection of node resources is performed on the basis of SSIDs. For example, connecting to the node with the node's call sign and an SSID of 1 will attach the user to the National Weather Service interface. Connecting to SSID 4 will let the user access the network, at which point the user can command the network node to list the other known network nodes, establish a circuit through the network, display node-activity statistics or access the message system.

The TEXNET network nodes under construction are two-port devices, with a 2-meter port for user access and a 70-cm port for node-to-node linking. The nodes will be operated from a battery and charger, providing emergency communication capabilities. Linking between nodes will be performed at 9600 bit/s.

The TPRS development team includes George Baker, W5YR, Tom McDermott, N5EG, and Tom Aschenbrenner, WB5PUC. TPRS expects to make printed-circuit boards and software available this summer.

Virtual Circuit Networking

A virtual circuit (VC) networking proposal based on CCITT X.25 was introduced by Terry Fox, WB4JFI, at the Third ARRL Amateur Radio Computer Networking Conference in 1984. Other early VC supporters were Gordon Beattie, N2DSY, Tom Moulton, W2VY, and Howard Goldstein, N2WX. Advocates of this approach point out that X.25 is an international standard in widespread use in commercial and government-owned packet-switched networks. Furthermore, unlike a datagram network, the network (not the endpoint) takes responsibility for delivering all packets where they are addressed and in the right order. One advantage of VC is that once a virtual circuit is established through a network, subsequent packets have less overhead in the packet headers, whereas datagrams contain the full address every transmission.

It was Howie who wrote the code for an X.25-based VC network protocol resident in a TAPR TNC 2 that was demonstrated at the Fifth Networking Conference at Orlando in 1986. A number of groups are experimenting with this networking protocol, but a final, field-tested package has yet to be released. Howie has written dual-port networking code for the PAC-COMM dual-port TNC, that will be released soon.

Shoot-Out at the Net Corral

Feast has replaced famine. We now have four different initiatives in amateur packet-radio networking: NET/ROM datagram, TCP/IP datagram, TEXNET datagram and X.25-based virtual circuit. The ARRL Ad Hoc Committee on Amateur Radio Digital Communication has decided that networking protocols must compete in field trials until such time as one demonstrates its superiority over the others. Once the facts are in, the Digital Committee will make a recommendation to the ARRL Board of Directors on a networking standard. This is not a matter merely for the market to decide, as users convinced that they need a networking protocol as soon as possible will favor whatever is working first. There are long-term and international aspects to this decision. It would be tragic if a short-term standard (de facto or otherwise) had to be thrown out because of lack of foresight. Similarly, whatever we pick should consider the needs of users in other countries. The ARRL, as the packet-radio clearinghouse for the International Amateur Radio Union (IARU), must continue to develop protocols worthy of acceptance by all IARU member-societies. QST

PX: Spring in Chester

Program 150 is a Commodore Amiga version of MINIMUF 3.5 (an MUF calculator) written by Ron Jacobs, WA1FSV (56 cents postage required).

Program 151 is an ARRL Sweepstakes Contest logging and duping program for the Commodore 128 and 64 computers (with disk drive) by Bill McClellan, KV0I (73 cents postage required).

Program 152 is a six-band Worked All States award tracking program for the Commodore 128 computer (with an 80-column RGB monitor) by David Bauer, KT0Q (56 cents postage required).

To obtain a listing of any PX program, send a business-size SASE with 39 cents postage (unless noted otherwise) to ARRL, Dept PX, 225 Main St, Newington, CT 06111 (CRRL members can send their SASEs to CRRL, PO Box 7009, Stn E, London, ON N5Y 4J9). Use a separate SASE for each program request and write the PX program number of the desired program at the lower left-hand corner of the SASE. Please do not send correspondence other than PX requests to Dept PX.

AMSAT PHASE FOUR INITIAL DESIGN REVIEW
April 4-6, 1987
Boulder, CO

PROCEEDINGS

1) Attendees: See RJANSSON's Telemail message of April 9, 1987, subj: Meeting Attendees

2) Jan King: Introduction and Objectives

Amateur Radio amounts to only 15% of a satellite project; 85% of the effort is in other disciplines such as basic spacecraft design, housekeeping, propulsion, etc. In addition, Phase 4 won't be exclusively an Amateur Radio project assuming that nonhams (space and scientific organizations) are involved.

We need to focus on public-service aspects of satellites and develop networks that allow the maximum number of people to benefit.

It is essential to maintain a momentum of technology development and a free exchange of ideas. We need to build spacecraft, not just talk about it.

Copies of The Soviet Year in Space 1985 and 1986 by Nicolas L. Johnson, are available from Teledyn Brown Engineering, 1250 Academy Park Loop, Suite 240, Colorado Springs, CO 80910. Write for copies.

We should come out of the meeting with an idea of how much the spacecraft and the ground network will cost for the ways-and-means committee. Is it possible to find another organization that is willing to fund for nonrecurring engineering (NRE)? AMSAT has a budget for 1987 costs of Phase 4.

2) Dick Jansson: Communication

It is essential that Phase 4 team designers carry on two-way communication, particularly through Telemail.

3) Paul Rinaldo: Comments on Program Applications

We need to estimate the size, demographics and communications requirements of the Amateur Radio community at the time Phase 4 is launched. Required ground equipment must be in place and in use for terrestrial communications.

Novice Enhancement should have an impact on Phase 4. Novices should be gatewayed into satellites at the earliest opportunity.

The "incubator" concept was outlined as a means of activating and networking experimenters. See April, 1987 QEX "Empirically Speaking" for the concept.

4) Jan King: Review of Phase 4 Spacecraft Concept

The object is to have the satellite available 24 h/day. Extensive study indicates the need for a geostationary orbit so users can rely on the S/C's availability, and can point and forget antennas. The most-populated areas of the earth are 120 degrees apart. A question is whether to put the satellites or the seams of the satellites' coverage over these populated regions.

The present concept for the Phase 4 S/C is a symmetrical cylinder with fixed antennas, in effect a 3-axis S/C. This creates a thermal gradient, ie, a difference in temperatures on various sides of the S/C. A fluid momentum controller can be used for 3-axis control by mechanical or magnetic pumping of fluid racing through tubes around the outer rim of the S/C.

5) Dick Jansson and Paul Hebert: Spacecraft Bus Characteristics

Computer-generated color slides of the spacecraft mechanical design showing individual and composite drawings of mechanical structure, heat pipe, transmitters, receivers, antennas, and batteries were displayed.

Paul Hebert showed an 8-minute videotape of the Phase 4 mechanical design, done as a college senior project. The video shows pseudo 3-D (rotating 2-D) views of components of the S/C.

6) Dick Jansson: S/C Thermal Design

Refer to a handout entitled "Phase IV Spacecraft Thermal Model Heat Pipe, Solar Panels, Solar Cells."

7) Bob McGwier: S/C Attitude-Control System

Flywheels are expensive because of necessary bearings. Fluid Momentum Control would consist of a fluid with magnetic particles suspended in it moved by a magnetic field.

Refer to BMCGWIER Telemail message of Mar 31, 1987, subj: FMC Loops.

8) Tom Clark: Sensors

The S/C needs a 2-D optical sun sensor to control tumbling, possibly one per quadrant. A concept of (24-cm) RF interferometry was described.

9) Dick Daniels: Propulsion

In Rich Fleeter's stead, Dick described propulsion options for orbit-transfer and reaction-control subsystems.

10) Jan King: Structure and Mechanical Design

Tom Clark said that XE1TU is a possibility for mechanical engineering.

11) Gordon Hardman: Phase 4 Bus Architecture

See paper entitled Phase 4 Bus Architecture, which proposes a 34-wire bus. Tom Clark raised the desirability of using a 9-wire bus, but this would depend on the availability of rad-hard bus-arbitration chips. A tradeoff study needs to be done on the number of wires and on-board complexity. It is desirable to have a standard bus to be used in conjunction with an IBM PC for use by experimenters.

12) Jan King: Communications Subsystem Design

The block diagram printed in the January 1987 issue of QST was reviewed. Two meters is needed for low-end users, but the requisite Yagi antenna is mechanically awkward. The 70-cm band should be used as a downlink.

There was considerable discussion of the feasibility of TV with full motion, color and commercial quality. Tony England said that he talked to NASA experts who said that they needed a 6-Mhz bandwidth.

13) Jim Eagleson: Report of Group 3, Transponder Design

500-kHz transponders were discussed. The group considered notching filters as a means of discommoding individuals who are in need of policing, but rejected it as ineffective. It may be desirable to have 1-MHz video, but a linear transponder bandwidth of 750 kHz seems comfortable. For wider bandwidths, it may be necessary to change from Helaps to a class-B design, which would lower efficiency. It is not out of the question to extend the Helaps design out to 2 MHz, but that would require R&D.

14) Jon Bloom: Report of Group 7, Network Concepts

Linking Voice Repeaters:

A repeater should be able to:

initiate a call request on a calling channel,
call CQ,
transmit point to multipoint,
receive bulletins on request,
dump other users and go to full power for emergencies,
store messages.

There is a need to develop a cellular map of the earth repeaters to determine how many repeaters would likely want access to Phase 4. Then, a mathematical model needs to be developed to determine who will want to talk to whom, when, and how often.

Television

The main application is commercial quality for interactive educational TV such as between classrooms, the space station, etc. Tony England believes that a T1 data rate (1.544 Mbit/s) should be practical. Educational uses are expected to be about 30 minutes at a time.

Packet

A single 25-kHz channel, as originaly proposed, is grossly inadequate. A T1 rate is probably more realistic for the 1990s.

Transponders

Two identical 2-Mhz-bandwidth linear transponders seem ideal. One could carry packet (data and TV) at a T1 rate using time division multiple access (TDMA). The other transponder would carry frequency-division multiplex (FDMA) signals which would include ACSSB for linking repeaters.

15) Skip Reymann: Report of Study Group 6, S/C Computers

The group selected the 80C86 microprocessor, which is available in a rad-hard version. A custom multitasking operating system would be used.

16) Phil Karn: Standards for Ranging

For Phase 4, we can expect no help from radar tracking stations because of the distance and small cross section of the satellite. A spread-spectrum ranging system was proposed which would resolve the range with 500 meters (1 bit period of a 250-kHz spreading key stream). Ranging from multiple stations would reduce uncertainty. Refer to paper entitled "Using Spread Spectrum for Ranging -- an analysis of spread spectrum ranging for the Phase IV Spacecraft," by Bob McGwier and Phil Karn.

17) Jan King: Telemetry and Command Standards

For telemetry, it is desirable to adopt the FO-12 standard -- 1200 bit/s, BPSK, AX.25 UI frames with variable block length. For command, use the same standards except that encryption should be added. Commands are to modify the CPU code or could control the bus for direct comand of devices connected to the bus. This area needs further discussion.

18) Tom Clark: Digital Signal Processing

A digital signal-processing (DSP) project was proposed so that practical amateur DSP could be available at the time Phase 4 flies. Perhaps this could be a joint AMSAT/TAPR/ARRL project. These is need to set minimal standards based on use of the TI TMS320 family which is based on mature technology, has an

established user base, a good software library, and current applications (filters, modems, spectrum analyzers, adaptive pulse-code modulation [ADPCM], and vocoders). Amateur Radio applications include virtual modems, newer coding schemes, rectangular spectrum modulation (RSM), ACSSB, weak-signal (such as EME) signal processing, WEFAX processing, and test equipment (FFT spectrum analysis, time sampling,propagation path analysis, and spread spectrum).

19) Jan King: Other Spacecraft Projects of Interest

Many small companies are scrambling for SDI dollars and will be saturating the US launch capability. Launches today are nonexistent except by Japan and the USSR. Ariane launches have excess capacities of 200-500 kg, but the 500-kg opportunities may be close to 1%.

No nation has submitted a report on the Amateur Satellite Service in over 10 years. This should be rectified.

Dick Daniels suggested building a GAS can S/C and try to get a slot from someone else who has a reservation but lost interest.

Phase 4 will take 4-6 paid employees for about 3 years and a facility. Industrial partnership should be explored but may limit posibilities due to conflict of interest. University affiliation is interesting but is more sink than source.

We need to explore cooperation with AMSAT overseas counterparts and the science community. The object is to open AMSAT perspectives wider than Amateur Radio, perhaps along the lines of UoSAT, which is half science and half Amateur Radio.

20) Dick Daniels: International Space Year (ISY)

Refer to paper entitled "The International Space Year (ISY)," by Dick Daniels. The major push in the US is to commemorate the 500th anniversary of Columbus` discovery of America during the 1992-1994 period. There is a potential for joint activities. How is it possible to take advantage of the ISY opportunity?

21) Laurie Wiggins: Lunar Polar Orbiter (LPO)

Scientists have long wanted an LPO to do geochemical exploration of the moon. The National Space Society (NSS) wants to do an LPO project and can supply people who are willing to volunteer their expertise. Other space/science organizations have indicated interest. An LPO could fly some hardware in common with Phase 4. Each country proposing an LPO has chosen the mother-daughter satellite concept, ie, a communications satellite provides relay because the LPO is sometimes behind the moon. Tony England said that this project has been proposed every year in the NASA budget and always has fallen below the funding cutoff line. He added that an LPO is several orders of magnitude greater effort than Phase 4. (Aviation Week and Space Technology carried an item

entitled Japan Plans Lunar Mission in 1990 in their February 23, 1987 issue.)

22) Jan King: Summary of Sunday Session

AMSAT should get together with ATS people to see if an ATS project by AMSAT is possible.

AMSAT should talk to LPO advocates concerning a joint activity.

AMSAT should explore experiments for earth science.

23) Jan King: 13-cm Band

Microwave oven interference peaks at 2500 Mhz. The band proposed for Phase 4 is the bottom 5 MHz, ie, 2400-2405 MHz.

24) Jan King: Emergency Direct Access

Modes J, L, and S1 could be available for emergency use. Tom Clark mentioned the time criticality of requirement such as the recent AMTRAK wreck. He noted that satellites are appropriate for widespread disasters, not train wrecks. Jim Eagleson pointed out that there are places in California so remote that they cannot be reached by local repeaters, thus a satellite would be useful for a localized emergency in such circumstances.

25) Bill Kleronomous: Repeater Lining via Satellite

Refer to a letter to Jan King dated 22 January 1987 with a paper entitled "Mode S2 Transponder Signalling and Control Considerations." POCSAG was suggested as a possible signaling system for repeater linking. It was developed by British Telecom, is in the public domain, and is used worldwide. Single-chip microcomputers are available for about $10 from Motorola, NEC, and Toshiba. Signals are transmitted at 512 bit/s using FSK. Complete paging receivers with POCSAG decoders are available. New Motorola receivers wholesale for $150, new NECs sell for $100, and used NECs are sold at $50 each.

Paul Rinaldo outlined the work done by Terry Fox on a pocket packet pager using AX.25; the hardware was breadboarded, but the software and a receiver needed to be completed.

After some discussion, it was agreed that a tradeoff study is needed to compare the merits of POCSAG, AX.25 and the Japanese DCS systems for both repeater linking telecommand and paging.

26) Paul Rinaldo: Packet Radio

The packet-radio population is growing at a rate of 300% per year and is near 30,000. How many there will be in the 1991-1998 time frame for Phase 4 has yet to be estimated. However, there will exist an extensive ground packet network with a voracious appetite. The packet network will, and must, function without a

geostationary satellite but will be looking to Phase 4 as a way of speeding up the data rate. The human perception of a computer network is that the service is slow if the response time exceeds 1 second. A synchronous satellite cannot offer that because of the propagation delay, but it will approach it.

Tom Clark added some information on current network topology, which consists of digipeaters and packet bulletin board systems, HF and VHF links, and the recent addition of a Wormhole (use of a nonamateur satellite to provide a high-speed packet link from Maryland to San Francisco).

27) Tony England: TV and Small-Scale Science

Interactive TV from an event to classrooms is something unique that the Amateur Satellite Service can offer.

AMSAT should pursue remote earth sensing requirements for Phase 4.

28) Action Items: See RJANSSON's Telemail message of April 9, 1987, subj: Meeting Action Items.

29) Additional Papers Available at the Meeting

"Radio Amateur Satellite Corporation (AMSAT-NA) Phase-IV Analog and Digital Networking," by Ralph Wallio, April 1, 1987.

"ACSB and CASROS," by James Eagleson, undated.

Respectfully submitted,
Paul L. Rinaldo, W4RI

PHASE FOUR INITIAL DESIGN REVIEW

March 4-6, 1987

Boulder, Colorado

AGENDA

Saturday, April 4

8:30 AM: Welcome and Introduction - Jan A. King

8:45 AM: Comments on Program and Review of Plans for Fund Raising for Project (Ways and Means) - V. Riportella

9:15 AM: Comments on Program Applications - Paul Rinaldo

9:45 AM: Review of Phase-4 Spacecraft Concept - Jan A. King

10:00 AM: Spacecraft Bus Primary Characteristics - Dick Jansson, Paul Hebert

10:15 AM: S/C Power Subsystem - Jan King, Dick Jansson

10:30 AM: S/C Attitude Control System - Bob McGwier

- o General Concept
- o Spacecraft Sensors
- o Fluid Momentum Controller - L. McFadden - B. McGwier
- o Bus Mechanical Properties - J. Zerr

11:30 AM: S/C Thermal Design - Dick Jansson

12:00 PM: Working Lunch (Big Mac, Fries, Etc.) Discussion of Morning Presentations

1:00 PM: Propulsion and Reaction Control Subsystem

- o A Freon Hot Gas Thruster as a Possible RCS Thruster for Phase-4 - R. Fleeter
- o Orbit Transfer Motor, Bi-Prop. vs. Mono-Prop. vs. Solid- R. Daniels (lead discussion)

2:00 PM: Structure and Mechanical Design - J. King and R. Daniels (lead discussion)

2:30 PM: A New Data Bus Concept for Phase-4 - G. Hardman

3:15 PM: Communications Subsystem Design

- o System Overview - J. King
- o Principles of Linear Transponders, High Efficiency Designs - G. Hardman
- o Antenna Design - Dick Jansson, Mike Staal
- o Microwave Beacon Experiment - OPEN
- o Status of S-Band Technology - G. Hardman
- o Implications of User Terminal Characteristics on S/C Transponder Design - J. Eagleson

5:30 PM: Dinner Break

7:30 PM 'til Exhaustion: Workshop Sessions to Address Specific Study Questions

- o Group 1: Establish First-Cut Design of Fluid Momentum Controller. Generate plan to build working model.
  - o Bob McGwier
  - o Lou McFadden
  - o Jeff Zerr
  - o Jan King (Part Time)
  - o Chuck Stout
- o Group 2: Review Viability of Freon Motor for Phase-4 RCS. Review alternatives and make recommendation. Review options for orbit transfer stage.
  - o Dick Daniels
  - o Rick Fleeter
  - o Laurie Wiggins

- Group 3: Review Transponder Design, Identify Critical Technologies, Plan Next Step in Design Phase
  - Gordon Hardman
  - Jim Eagleson
  - Mike Staal
  - Mark Schieber
  - Pat McGivney
  - Jan King (Part Time)

- Group 4: Plan Next Phase of Thermal Subsystem Design
  - Dick Jansson
  - Brent Helleckson
  - Jan King (Part Time)

- Group 5: Review Concepts for a Next Generation Ranging and Orbit Determination System for Phase-4. Plan Next Step. Identify Componenets that may Need to be Breadboard Tested.
  - Phil Karn
  - Bob McGwier (Part Time)
  - Bill Bard
  - Joan Parker

- Group 6: Review Concepts for New S/C Computers. Determine value of Keeping Phase-3C Computer as Primary Controller, Augmented by New, More Capable Machine.
  - Group 5 (after task is finished) +
  - Chris Kelly
  - Steve Robinson (?)
  - Skip Reymann
  - Randy Smith

- Group 7: Review Ground Network Concepts. Identify Critical Equipment to be Developed. Determine Key Steps in Ground Network Plan.

  - Paul Rinaldo
  - Bill Kleronomous
  - Vern Riportella
  - Jim Eagleson (Part Time)

Other groups can be formed as necessary. Each group should plan to issue a report on their results. The report need not be completed by the end of the meeting but, should be completed by one of the members within a week or so and then mailed to members of the study team. Where applicable, each group should estimate the costs expected for the particular hardware they envision. This latter step is very important. -More so than in the past! We also need estimates of the mass and power requirements of all of the spacecraft hardware. Size is probably less important right now.

Sunday, April 5

9:00 AM: Spacecraft Onboard Processing

- Basis: the IHU Concept - Jan King
- Interaction of an IHU with an Advanced Data Bus Concept - Gordon Hardman
- Advanced Computer/Controller Concepts for Use In Future Amateur Space Projects - Phil Karn, Bob McGwier, Skip Reymann
- On board signal processors, TNC's, Other - Tom Clark
- Standards for Telemetry, Command and Ranging - P. Karn, T. Clark

11:00 AM: Other Topic Re the Phase-4 Spacecraft

12:00 PM: Lunch

1:30 PM: Other Spacecraft Projects Of Interest to The Group

The idea, here, is to review projects that may be done in conjunction with Phase-4 as a method of offsetting the costs of the project. This discussion is intended to determine the scope and potential benefits of such projects.

- o Current Status of Small Satellites in the Aerospace Industry - Jan King
- o Possible GAS CAN Satellites - R. Daniels
- o Possible Phase-4-Type Satellites for Use by Industry or Other Countries - Jan King
- o Possible Spacecraft for Science
  - o Lunar Polar Orbiter - Laurie Wiggins
  - o Missions Related to the ISY (1991) - R. Daniels
  - o Complete Missions Under Review by Other Groups: e.g. Solar Sail, Small Space Telescope - OPEN

4:00 PM: Summarize Status of Design and Assign Action Items - Jan King and Dick Jansson

5:00 PM: Dinner

7:00 PM: Party - Location to be Announced.

Monday, April 6

8:00 AM: General Objectives of the Ground Network for Phase-4 - Paul Rinaldo and Vern Riportella to Lead Discussion

8:30 AM: General Communications Transponder Issues - Jim Eagleson

- o Acceptability of Frequency Bands Selected
- o 2m Receive Band Performance -(i.e. how much satellite antenna gain?)
- o Passband Requirements for Each Mode
- o Allocated Power for Each Mode

9:00 AM: Repeater Gateway Transponder - Bill Kleronomous

- o Network Architecture
- o System Capacity
- o Control Facilities
- o Standard User Equipment Required
- o Modes of Operation

10:00 AM: Packet Gateway Transponder - Paul Rinaldo

- o Network Architecture
- o Regenerative vs. Linear Transponders
- o Data Rates (Uplink and Downlink)
- o Standard User Equipment Required
- o Modes of Operation

11:00 AM: General Purpose Wideband Data Transponder - Jan King

- o Network Architecture
- o Digital Video Applications
- o Support of Space Station Education - Tony England
- o Ultimate Goal - Amateur ISDN
- o Standard User Equipment Required

12:00 PM: Lunch Break

1:30 PM: Review of Applications for Phase-4 System

2:30 PM: Other Topics as Appropriate

3:30 PM: Close of Meeting; Assignment of Action Items

AIRSIGNAL, INC.

695 South Colorado Blvd. • First Floor, Suite 160 • Denver, CO 80222 • (303) 778-7878

22 January 1987

Dear Jan:

Attached please find an outline of my signalling suggestions for use on the Phase 4 mode S2 transponder for your perusal.

As you will see, I am suggesting a direct station to station signalling approach, rather than using a centralized demand assignment system. I am also suggesting the use of a one way signalling format called POCSAG which has arithmetric error correction at the recieve end only. Plain old ASCII could also probably be used, but there is no error correction capability. I feel the back and forth error free system used in packet eats too much time, is unnecessary, and might not support all you want to do.

I'm going to be real busy the next month or so, and so are you, I guess, but perhaps either yourself or someone else within AMSAT might want to critique my proposed approach and get back to me on it.

Regards,

Bill

Bill Kleronomos
KDØHG

KDØHG 15 JAN 87

MODE S2 TRANSPONDER SIGNALLING AND CONTROL CONSIDERATIONS

In a recent document, Jan King outlined a plan for how he envisioned the mode S2 would be used in interconnecting repeaters and remote base stations as well as suggesting a possible protocol for signalling and control purposes. I'd like to comment on the plan and make some suggestions for possible changes and enhancements.

The origial and most recent proposal suggested the following system outline:

1. Approximately 20 channels, 1 channel being dedicated to being a pilot carrier for phase lock of ground stations and carrying telemetry (PSK or FSK) for adressing and controlling stations on the network. A second channel would be dedicated for demand assignment purposes.

2. The ground stations would be under the control of a master control station. In practice, a request for a channel would be transmitted via the transponder to this master control, which would adress the called station via the telemetry channel, and direct both stations to an open channel where a QSO would commence.

3. The ground stations would contain a synthesized ACSSB transceiver operating crossband on the up and downlink bands, and also a second receiver dedicated to the pilot - telemetry channel.

This second receiver would be for the purpose or receiving control and channel assignment data as well as for providing a demodulated frequency reference to the system.

4. The following functions are to be supported by the signalling and control protocols:

a) A "CQ" mode,
b) A direct call mode,
c) a multiple "CQ" mode, to call several stations for a net,
d) A regional or directional "CQ" mode, such as western USA, etc.,
e) An emergency call mode, to bring up or find a specific station(s),
f) Two "All-Call" modes-
   1. To broadcast priority information to all or selected stations,
   2. To do the above with the addition of using all available transponder power on one channel only obtaining some 13 db signal improvement in the process.
g) The ability to send a limited amount of data to another repeater/remote base in addition to its adress for various remote control purposes. (Turning on crossband links, and, for those AT&T haters, operating an autopatch in another city, etc.)

DISTRIBUTED SYSTEM LOGIC

I am proposing the following revised version of Jan King's proposal.

Downlink Receivers-

Dual type, one dedicated to system pilot/data channel, and one a scanning type, scan rate, 20 CH/SEC, under uP control.

Uplink transmitter - Synced to scanning reciever on uplink half of channel pair.

Satellite S2 Transponder - Approximately 20 5Khz wide channels with one dedicated to being a pilot carrier/data channel, and one dedicated to emergency use only.

© ARRL NO?

Master Control Station- Two uplink transmitters, one for pilot channel, and one for emergency channel. One reciever capable of simultaneously listening to all channels and acquiring data sent on each.

PROS AND CONS

I do not believe that it is necessary to route all signalling and station to station calls (demand channel assignment) through a central control station. I see the following problems with this approach-

1. Nobody can interconnect if the main computer or its associated RF hardware fails. The system becomes useless.

2. The approach is highly vulnerable to jamming, with the same results.

3. There is a high probability of data clash caused by simultaneous channel assignment requests on one channel.

4. A CQ function would be difficult to implement. Who would it assign the call to?

The main advantage to a demand assignment system is the control over who can use the system which I feel is unnecessary for amateur use. A 'pay to use' approach might be counterproductive as well as illegal. The other advantage is insuring that during periods when all channels are busy, channel requests are handled on a first come first served basis. The alternative approach I am suggesting changes 'first come, first served', to 'you've got the same chance as anyone else to get a frequency'. Hey, anyone that operates 20 meters on weekends will be quite familiar with this! I'd like to see someone do a statistical analysis on this: under peak useage conditions, what would the wait be for an open channel with both approaches?

SYSTEM OPERATION

Under normal circumstances, an idle downlink reciever is scanning all channels, except for the pilot. If, on succesive scans, it finds a formerly busy channel is now open, it initiates a timer. If the channel shows no activity for a period of 10-20 seconds, it calls the channel 'open' and available for use.

Call initiation.

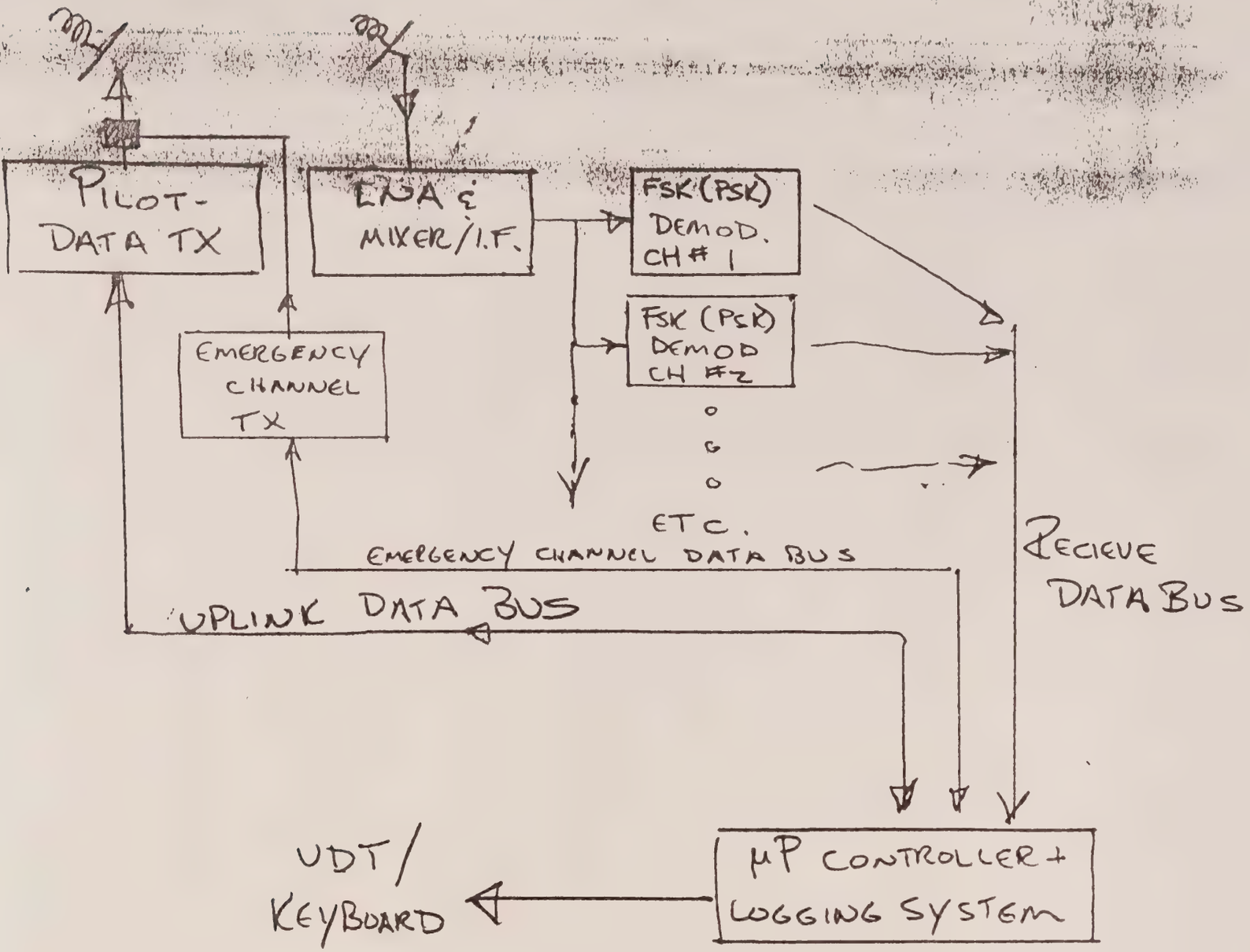
The operator enters a function code and destination adress on his DTMF pad. The system uP goes to an open channel (the one open the longest) and verifies its availability. If busy, it goes to the next one; it noted as open, etc. If all channels are busy, a telemetry beep will be sent to the operator. Or, it can continue to look for an open channel for a specific time. Up to a five minute wait is probably acceptable and insures efficient system useage. As the stations will not be scanning in sync, except for very brief periods, and they all use the same 10 second determination for an idle channel, it is moderately unlikely for two stations to try to adress the same transponder at the same time.

Assuming the station finds an available transponder channel, some 1.13 S. of preamble is sent. All other stations in idle mode which are scanning will stop on this channel and read the first 18 adress bits of the message. If not directed to a station, or if not a "CQ" or the like, they will resume scanning. The 10-20 second criteria for defining a channel available will allow for an initial voice exchange should a call be successful.

Master Control Base Operation

This station is constantly listening to, and reading the data sent on each channel. It has a constant record of the following information, which can be displayed on a VDT: Called station, calling station (by assigned system # and real call letters), time contact started and duration of contact. While the data for, and contacts are not routed through this control center, it has the capability to terminate contacts via the pilot channel. Records can be kept of parameters and users of the system. An associated commercial database program could provide useful ststistical data to AMSAT or ARRL.

MASTER CONTROL BASE STATION



SAMPLE UDT LOGGING DISPLAY

CHANNEL	STATUS	CALLED STATION	CALLING STATION	START GMT	DURATION MINUTES
PILOT	ON-LINE				
1	INSUSE	0112 KDØHG	0664 K7WS	2002	2
2	IN USE	0031 G3PAC	0988 KP4AST	1942	20
3	IDLE	0901 K9FOV	1032 WB8FZZ	1955	5
4	IN USE	CQ W6	0678 ZS6AT	2004	0
5	*PRIORITY3*	0001 W1AW	0065 W6AA	2003	1

EMERGENCY USE

As I previously mentioned, one channel is reserved exclusively for emergency use. In practice, a station would uplink an emergency call on this channel. It would then signal the called station, or, various levels of priority could be assigned. Don't forget that all stations are continuously monitoring the pilot channel.

Levels-

1. A direct call to another station on the priority channel.
2. A call which instructs the master control station to see if the called station is busy on the system, and if so, terminate his contact via the pilot, and direct his frequency to the priority channel.
3. Terminate all contacts on the system. Broadcast an emergency message on the priority channel using all available transponder power.

SIGNALLING PROTOCOL

Several protocols have been proposed for the system, including AX.25 type packet and the type used for cellular telephone systems. I feel that these protocols are time consuming, will tie up valuable transponder channels, and their verification features to insure data integrity are cumbersome and unnecessary. As Jan points out, it is no big deal if one occasionally gets a call for someone in Rangoon!

I am suggesting the use of a signalling protocol used in the paging business for signalling and transmission of numeric and alphanumeric pages called POCSAG for the purpose of interstation signalling and control. It's relatively fast (512 BPS), and contains data and parity bits for arithmetric data correction. The protocol is in worldwide use and is an industry standard. The computer programs for its generation and decoding are not very complicated.

All system stations will have a three or four digit adress assigned to it by AMSAT or ARRL.

To get a feel for system operation, I have made up a short list of possible control functions that could be sent to a repeater via DTMF for use with the mode S2 transponder.

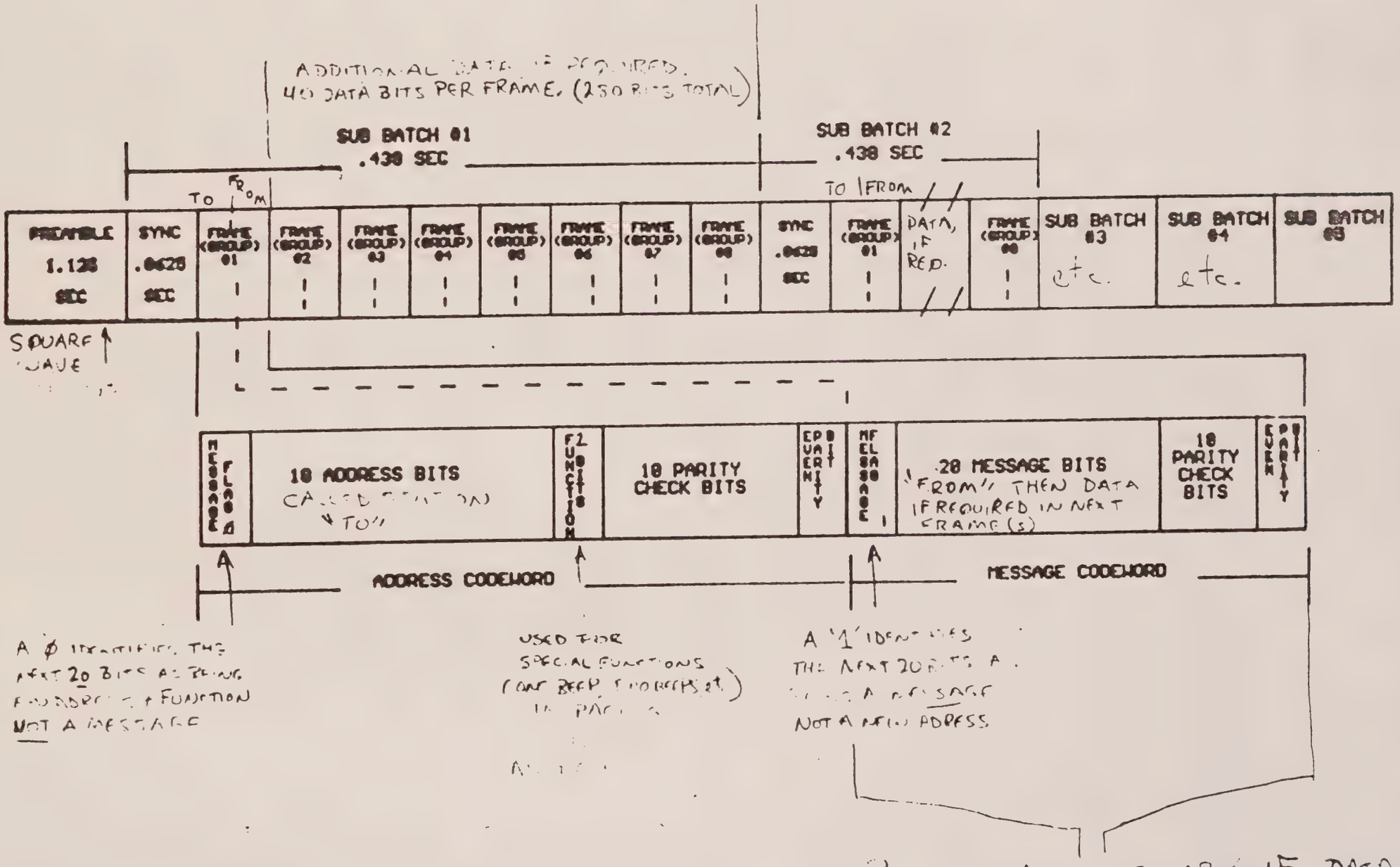
RECIEVE FUNCTIONS	TRANSMIT FUNCTIONS
000 - Off-line, no calls accepted	100XXX# - Call Station XXX
001 - Emergency calls only	101# - Call CQ
002 - Calls for a net only	102XXX# - Priority call to XXX
003 - Any call accepted	Connects them even if busy
00401# - Listen to channel #1	103XXX# - Calls XXX and sends
ETC...	data to turn on autopatch, link, etc

Some similar coding scheme to accomidate the desired set of functions need to be implemented.

DATA RATE @ 512 BPS

POCSAG

POST OFFICE CODE STANDARDIZATION ADVISORY GROUP



Posted: Thu Apr 9, 1987 2:04 AM GMT Msg: IGIH-2913-7616
From: RJANSSON
To: P4ST
CC: PRINALDO
Subj: Meeting Action Items

The following is a list of the Action Items resulting from the meeting of the Phase 4 Study Team, 4-6 April 1987. The order presented has no bearing upon the relative importance of the respective items, merely the order in which they were recorded by this scribe.

1. Trim the Solar-Panel/Heat-Pipe thermal and physical design, trading off some of the thermal performance to lessen estimated mass values.
   Action On: Dick Jansson
   Due Date: 15 May 1987

2. Physically model (read that as "BUILD the DAMNED THING") the FMC loop with multiple drive options (immersed mechanical pump & direct electro-magnetic pumping), and with multiple fluid options.
   Action On: Bob McGwier & Lou McFadin
   Due Date: Mech. Pump, 1 July 1987, Elect. Pump, 1 Sept. 1987

3. Define propulsion system, both insertion motor & station keeping motors.
   Action On: Rick Fleeter & Dick Daniels
   Due Date: 1 July 1987

4. Define command system architecture for tracking, telemetry, and control.
   Action On: Skip Reymann
   Due Date: 1 July 1987

5. Report of sub-group on computer architecture, ranging & orbit determination.
   Action On: Skip Reymann
   Due Date: 20 April 1987

6. Report of sub-group on communications transponders.
   Action On: Gordon Hardman & Jim Eagleson
   Due Date: 20 April 1987

7. Report of sub-group on attitude control & FMC.
   Action On: Bob McGwier
   Due Date: 20 April 1987

8. Report of sub-group on thermal/structural designs.
   Action On: Dick Jansson
   Due Date: 20 April 1987

9. Report of sub-group on ground network concepts.
   Action On: Paul Rinaldo
   Due Date: 20 April 1987

10. Define usable televison requirements & standards.
    Action On: Tony England
    Due Date: 1 July 1987

11. Define possible practical camera requirements.
    Action On: Jacky Radbone
    Due Date: 15 May 1987

12. Identify potential experiments packages.
    Action On: Paul Rinaldo & Tony England
    Due Date: 1 August 1987

13. Define transponder user requirements.
    Action On: Paul Rinaldo & Tony England
    Due Date: 1 September 1987

14. Transmit CAS experiment data to Paul Rinaldo.
    Action On: Jim Eagleson
    Due Date: 1 July 1987

15. Provide estimated cost and mass data for all subsystems.
    Action On: ALL
    Due Date: 1 May 1987

16. Provide an antenna preliminary design.
    Action On: Mike Staal
    Due Date: 1 July 1987

17. Provide a repeater gateway design, considering the respective advantages of packet and DPLL for paging and calling.
    Action On: Bill Kleronomos
    Due Date: 1 July 1987

18. Provide a copy of a paper on "Preventive Measures for Passive Intermodulation", to transponder interests.
    Action On: Jan King
    Due Date: 20 April 1987

19. Locate a participating spacecraft structural designer/engineer.
    Action On: Laurie Wiggins
    Due Date: 1 May 1987

20. Define the guiding precepts for the basic spacecraft structural design.
    Action On: Jan King & Dick Jansson
    Due Date: 1 May 1987

21. Provide a transcript of the proceedings, to the extent practical.
    Action On: Paul Rinaldo
    Due Date: 15 April 1987

22. Define power sub-system batteries.
    Action On: Laurie Wiggins to follow-up on Pat Mcgivney
    (We need more interest in this area!)
    Due Date: 1 June 1987

RADIO AMATEUR SATELLITE CORPORATION (AMSAT-NA)

PHASE-IV Analog and Digital Networking

Ralph Wallio, W0RPK
Vice-President of Operations
April 1, 1987

Scientists, engineers, managers and directors of AMSAT-NA are currently studying the feasability of funding, designing, constructing, launching and operating geosynchronous communications satellites in the amateur radio service. This effort, known as PHASE-IV, is in natural progression with 25-years of success with OSCAR (Orbiting Satellite Carrying Amateur Radio) projects of increasing complexity and capability.

Managers of AMSAT-NA have proposed that a significant portion of communicating transponder capacity of PHASE-IV be devoted to advanced analog and digital ground networks. Further, they propose that these networks be optimized to radically improve the quality and quantity of amateur radio public service communication.

This discussion of PHASE-IV networking touches on the problematic issues of amateur radio public service activity and the current state of amateur radio networking. Network functions, capabilities and user interfaces are detailed and finally, specific technical designs are suggested.

AMATEUR RADIO PUBLIC SERVICE ACTIVITIES

The AMERICAN RADIO RELAY LEAGUE (ARRL), its Amateur Radio Public Service Corps (ARPSC) including the Amateur Radio Emergency Service (ARES) and the National Traffic System (NTS) provide the organization for the majority of amateur radio public service activities. The LEAGUE provides the organization, leadership and publicity necessary to sustain our continuing productive attitude toward public service.

However, a disappointingly small proportion of active amateur radio operators devote a disappointingly small proportion of their operating time on public service activities. The average amateur radio operator doesn't appear to understand that the future of our hobby depends on continuing support from the general public. In fact, most active hams don't spend ANY time in public service mode. What assistance we do provide is mostly due to dedication shown by a small handfull of individuals who devote the majority of their hobby time to public service.

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The long-term result of our limited response to our public service responsibility is that we have severely limited our chance to function in matters of consequence. While stories in QST and what little publicity we get in the public media would lead the uninformed to believe we play a much larger part, the fact is we are given very little opportunity to provide important radio communication support.

Not one widely recognized public service organization regularly and universally depends on amateur radio communication for their operational functions. While paper agreements may exist, federal, state and local public safety agencies rarely assign specific communications responsibilities to amateur radio organizations. The reality is that our continuing public service responsibility has been reduced to supporting non-emergency activites, i.e., parades and races, through the ARES and handling a few low priority messages through the NTS.

Fortunately, when true emergencies requiring local, regional, national or international amateur radio communication support do arise, we respond. Volunteers and leaders come "out of the woodwork" to provide their time, equipment and experience to directly or indirectly save lives and relieve suffering.

AMATEUR RADIO NETWORKING

Local repeater operation, typically but not limited to 2m FM, is by far our most successful networking achievement. The ARRL REPEATER DIRECTORY for 1986-1987 lists over 10,000 repeaters each of which is the focal-point of a local area network (LAN). The advent of these LAN repeaters has improved the quality of local amateur radio communication such that it rivals that available to public safety agencies. Acceptance of local voice networking has matured to the point that most active amateur radio operators are equipped with 2M FM capability and use it regularly.

It appears that we will also collectively accept local area networking in the packet radio digital mode. While digital communication techniques may never approach the popularity of the voice mode, sales of terminal node contollers (TNC), proliferation of digipeaters and packet bulletin board systems and regional networks are growing at a rapid pace.

Voice networking on a regional and national scale is another matter entirely. Beyond the National Traffic System, with its ARRL sponsorship and a tradition leading back to the earliest days of amateur radio, we have not come close to using the technological capabilities we already possess to develop organized regional and national communication networks.

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When investigating even the simplest of networking methods, meeting on a published frequency at a given time for a common purpose, one finds universal problems with interference, noise, propagation and operating methods that radically reduce network capability and reliability. Collectively, we have not gone even so far as segmenting our H.F. bands for networking vs. other uses by, for instance, denying contest operation in a small segment in each band.

We show signs of being much more aggressive with digital networking. Even without significant leadership and direction, informal packet radio bulletin board networks have evolved using both VHF/UHF digipeating and HF point-to-point methods. The ARRL is now prepared to provide the leadership necessary to establish a formal well thought-out regional and nationwide H.F. networking plan. Execution of this plan will allow the first major improvement in NTS traffic handling capabilities in decades.

However, this plan, like the informal PBBS networks now in operation, will only be able to handle non-realtime message traffic and will be dependent on the vagaries of H.F. propagation. More capable and reliable terrestrial networking methods have been discussed (loosely known as LEVEL 3 networking) but we aren't close to developing a technically, operationally and economically feasible plan.

AN AMSAT-NA PHASE-IV NETWORKING SOLUTION

Our proposal to devote communication capabilities of a PHASE-IV geosynchronous satellite (the SPACE SEGMENT) to public service networking must be matched with a comprehensive GROUND SEGMENT plan. Together, these segments would comprise truely revolutionary voice and digital networks. Use of these networks would yield a quantum leap in communication reliability and connectivity which would allow much wider possibilities of public service operation.

Using these new capabilites as a catalyst, the ARRL would have a new focal-point for their publicity effort to significantly increase the proportion of amateur radio operation directed toward public service concerns. The combination of improved possibilities, vigorous leadership and available volunteers could radically change the character of services we can provide to the public.

To achieve this goal, we must develop network plans

- that are easy and inexpensive to implement,

- that have acceptable user operating requirements and

- that provide a very high level of reliability.

Ground segment equipment designed by engineers associated with AMSAT-NA and publicized by the ARRL will have to be purchased and installed by local groups just as they have supported local repeaters, digipeaters and/or packet radio bulletin board systems. The ultimate quantity of this equipment will be small enough (estimated to be 250-500) that delivery methods akin to TAPR TNC kits or kits available through small small entrepreneurs will be used to make the technology available to local groups.

Very little widely available commercial equipment or assemblies will be used to implement local voice or digital network GATEWAYS. The cost of a completely operational gateway should not exceed that of a high quality 2m repeater or wide-area coverage digipeater and bulletin board system (approximately $1000).

User operating requirements should not exceed what is already available to individual amateur radio operators and should be universally applied throughout the network. Voice users should be able to manipulate network functions with DTMF (dual-tone multiple-frequency) ("TOUCHTONE") signaling and communicate with existing VHF/UHF FM equipment. Access to gateways should be open to all potential users without regard to local group membership.

For continuing user acceptance, network reliability must significantly exceed that available on the HF bands. The PHASE-IV space segment must be designed to be operational continuously and ground segment gateways must be designed such that their reliability is at least as good as local repeater or digipeater facilities. Operational variables of previous OSCAR projects have been accepted by only a small cadre of enthusiasts. General acceptance by most active amateur radio operators will require space segment reliability beyond that we have previously experienced.

PHASE-IV NETWORK CONCEPT AND FUNCTION

Figures 1 and 2 outline voice and digital communication via ground segment gateways and space segment transponding. We estimate that gateways would function in all 250 metropolitain statistical areas and, with multiple gateways in the larger mega-metros and a few in very small markets, the number could approach 500.

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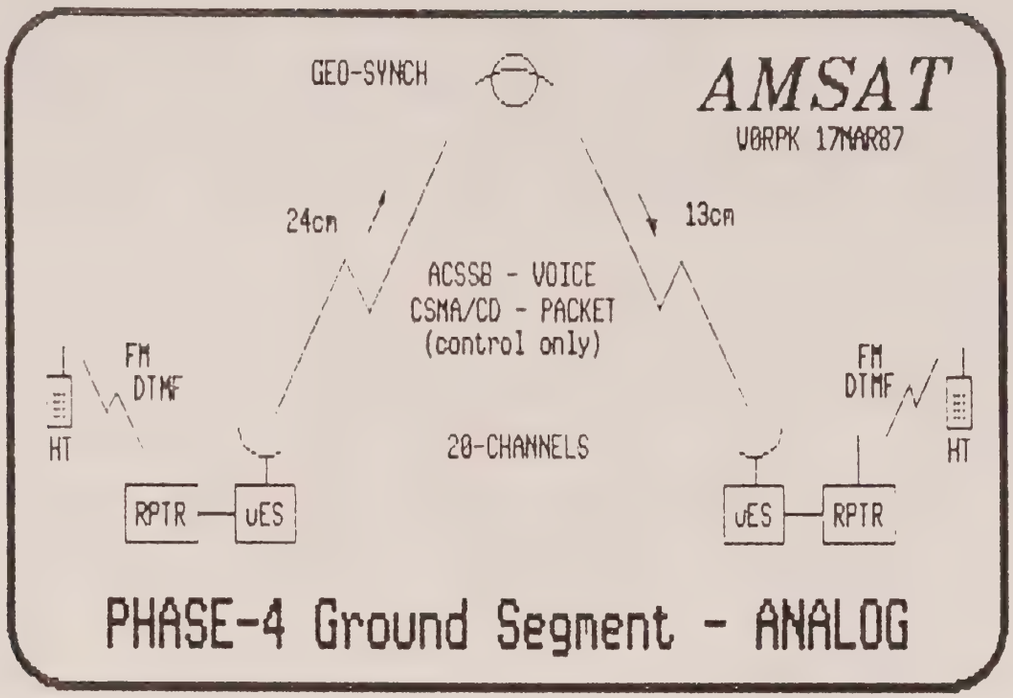

User access to gateway and network functions is via conventional VHF/UHF FM technology. To keep cost down, an existing repeater could be used to link the user to his local gateway. Interconnection between the repeater and gateway must be kept simple and universal such that almost any existing repeater configuration can be accomodated.

Users should be able to access all 20 network voice channels via DTMF signaling control. Gateway internal-housekeeping-units (IHU) would respond to these commands by switching up- and downlink frequency and by transmitting to and receiving control packets from other gateways.

Gateway functions controlled via local user DTMF command should include the following (in order of increasing system complexity):

1) Connect the voice gateway to the attached repeater in a LISTEN ONLY mode.

2) Selectively listen to any of 20 network channels (to monitor any QSOs, nets or bulletins in progress).

3) Enable gateway uplink operation on a selected channel (to join a QSO or net in progress).

4) Attempt a CONNECT with a remote gateway and attached repeater by "dialing" a published DTMF address. (In this case the local gateway would signal remote gateways via digital packets to determine availability and to QSY to an idle channel.)

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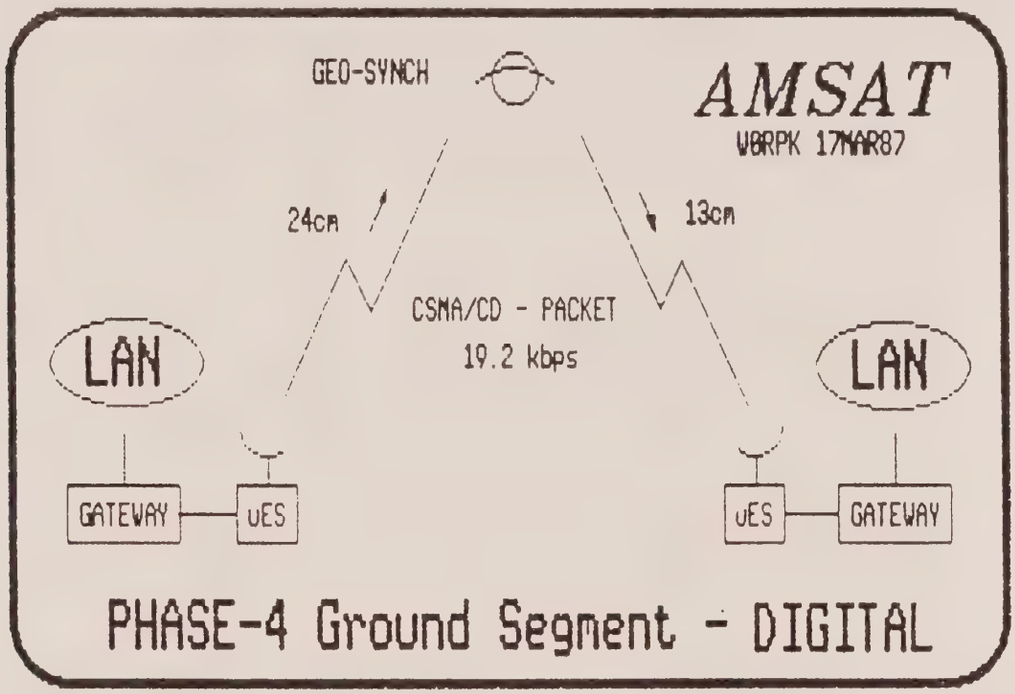
Gateway functions controlled by IHU software and in response to control packets from other gateways should include:

A) Constantly monitor the network control packet channel looking for enquiry and command packets with its address.

B) Respond to received packets with acknowledgements and status information as required.

C) Maintain a realtime channel status table based on monitored packet information.

D) React to commands from a central authority to reset, dump status, reserve channels or go offline.



Packet radio users would CONNECT with the gateway and, using a keyboard input command set, cause the gateway to logically link itself to other gateways with an as yet unchosen level 3/4 protocol. Key user functions would include:

1) CONNECT with gateway on one of several AX.25L2 ports and establish a command link.

2) Establish a gateway-to-gateway level 3 link to a remote gateway and monitor packet traffic in a remote local-area-network.

3) Originate packets on the above link to be seen in in the remote LAN including the ability to CONNECT with level 2 stations.

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4) Establish a level 2 CONNECT with a station in a remote LAN by commanding the local gateway to automatically handle the process.

Each digital gateway would monitor the network channel for control packets and respond when necessary. A priority mechanism will be necessary to allow various grades of public service traffic to have precedence over routine QSO packets.

NETWORK SYSTEM DESIGN

Development and operation of networks of this magnitude will require significant achievements in several disciplines including systems analysis and design, I.H.U hardware and software, L-band and S-band R.F. and antenna design and overall project management.

In clear violation of the established concept that "they who do the work get to make the decisions", I offer the following design suggestions derived from a multitude of conversations and expert sources:

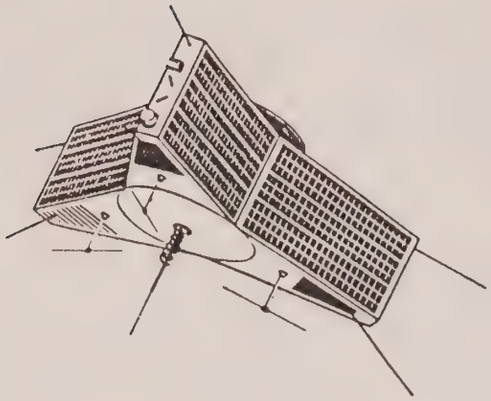
1) Voice and digital network design should have all gateways interacting with each other on a peer-to-peer basis, that is, no master station should be required for normal operation. However, AMSAT-NA would have to run such a master station for diagnostic, recovery and emergency control purposes.

2) User access to voice and digital gateways should require only the existing standards of DTMF equipped FM rigs for voice and AX.25L2 for packet radio.

3) Similar IHU hardware and operating systems should be used for both voice and digital gateways. This hardware should use 68000-series microprocessors and run a multi-tasking operating system such as MICROWARE OS-9.

4) The R.F. design should include remote receiving down-converters and transmitting up-converters placed at the antennas to eliminate feedline loss problems. These converters should be operated by simplexed power on the I.F. feedlines.

During the upcoming design process we are being given the opportunity to solve very interesting technical challenges, to allow a much wider segment of ham radio operators to directly benefit from the OSCAR program and to significantly improve our response to public need. Lets use the talent and take the time to do it right!



ACSB and CASROS

by
James Eagleson WB6JNN
President, Project OSCAR
15 Valdez Lane
Watsonville, CA 95076

Since UHF / L-band satellites are firmly part of the Amateur Satellite program's future, some would rightly ask "Why bother with ACSB or SSB on these 1 MHz or wider satellites when FM can provide better quality and has been proven by its extensive use on commercial satellite links?"

It is certainly true that FM is the mode of choice for many services on current commercial satellites, but this is not universal. California Microwave, and others, have converted much of their operations to ACSB-like modes to provide up to 6000 links where only 2000 or less were previously available.

Actually these systems use a mix of ACSB, FM, and various data transmission techniques, depending on customer requirements.

Amateur requirements are much less critical in terms of numbers of users.

My observations of western and midwestern passes of OSCAR 10 over the past two years show typical useage to be about 10-12 SSB QSO's in the upper half of the passband at any given moment. Thus we have slightly over one QSO per 5 KHz, typical. It was also noted that the density was slightly higher in the 145.900-930 region than in the 930-950 region so that 3-4 KHz spacing was common in the more crowded parts of the passband.

I have been able to observe only a few European-US passes since these have not usually been at a convenient time or elevation angle at my location. Useage on these passes has been much higher... perhaps approaching 2.5 KHz per QSO over about 60 KHz of the passband. Thus we sometimes see 20-25 QSO's at any given moment during peak useage times for a total of 40-60 users.

The CW portion of the satellite is not used nearly as extensively as the Voice portion on most Western passes (only 4-5 QSO's) and most Mid-USA passes show only slightly more activity. Admitedly, I have not spent a great deal of time looking for CW stations in my studies, however.

There are typically one or two SSTV QSO's evident on null-free passes and some RTTY and Packet activity when signal levels are high enough. However, it is probable that more than two users are represented by each QSO since RTTY and Packet users tend to flock to one or two frequencies.

Even with 1 MHz or even 10 MHz wide satellites on the horizon we can expect that the usage level of such satellites for DX activity will not increase significantly. Most such activity will probably center around a small portion of the total passband and take up less than 100-200 KHz. Let`s face it, DX tends to be a herd activity where 20 or 30 bulls all fight over the same poor cow!

Ragchewing and Technical Discussions have been much more evident on OSCAR 10 than on earlier satellites because of the much longer access time available. Technical discussions and liaison activities seem to occur higher in the passband around 145.840-145.850 MHz where the concentration of other users tends to thin out.

These activities will probably take up only 200-400 KHz of the passband on a 1 MHz wide satellite and the same spectrum will also support the more casual DX contacts.

Specialized modes such as SSTV and RTTY/Packet will most likely require only 100 KHz or so with most CW activity able to operate in a similar but seperate 100 KHz segment.

Thus we have 700-800 KHz committed for activities already existing on OSCAR 10 with the remaining 200-300 KHz available for other possible activities. Please keep in mind that these figures are estimations of requirements on my part based on current activities. I project that these will be the likely spectrum requirements. The actual AMSAT recommended band plan could be some other mixture, however.

FUTURE ADDITIONAL USES

If my projections hold true, we should have about 300-400 KHz left to be used in some other fashion not currently being exploited on our satellites.

Some of these uses could be interlinking activities, teleconferencing networks, traffic handling networks, bulletin services, emergency communications, and a variety of other things left to the imagination of the Amateur Radio Community.

How can best implement these new services with minimum impact to current services? With the wider available pass band should we look at alternative modes other than SSB?

WHAT IF WE USE FM?

If FM was to be used in the 400 KHz wide general activity portion of the passband, we could only fit about 20 QSO's in the band. Thus FM would be acceptable for a 10 MHz wide satellite, but NOT in a 1 MHz wide system.

Even with 15 KHz spacing, technically possible since levels arriving at and from the satellite are all about equal in strength, we can only achieve about 27 QSO's (60-70 users) in 400 KHz.

It is unlikely that DX activities will use FM since the weak signal and interference rejection capabilities of SSB are so superior for this purpose. Since the suggested 100 KHz reservation for this activity would provide 20-40 QSO's for 50-100 stations or more at any given moment, it should be adequate! As I said, DX tends to be a herd activity.

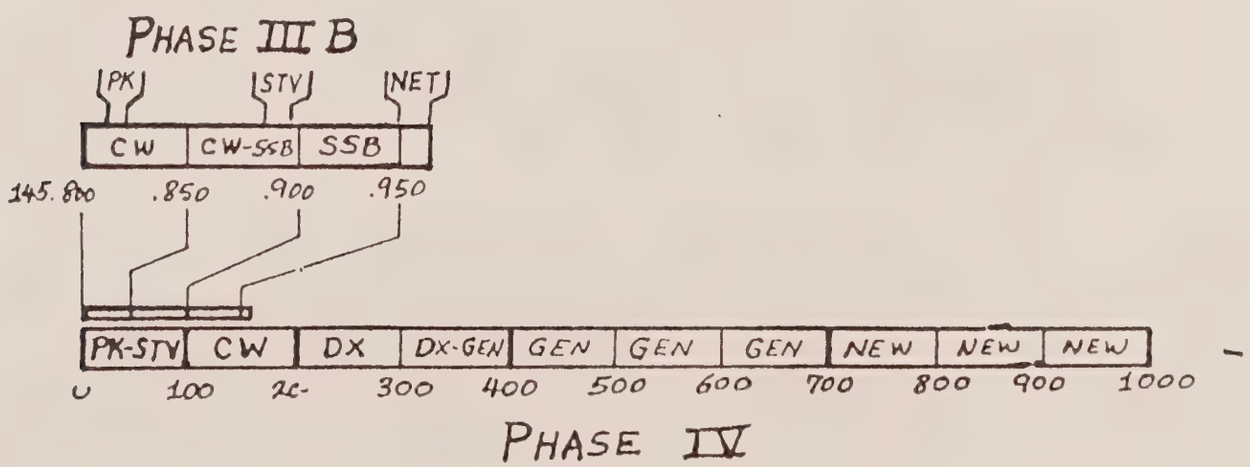
CW and Special Mode users won't want to give up any of their spectrum to expand the general activity voice band. just to support the use of FM. The allocation suggested should support 50-100 QSO's for 100-300 stations since 1-2 KHz spacings are quite practical for these modes.

Therefore even if we use all of the 700 KHz left after removing 300 KHz for DX, CW, RTTY, and Packet, only about 47 QSOs at 15 KHz spacings or 35 QSO's at 20 KHz spacing would be possible using FM. This would support only 100 to 150 users.

Maybe we DO need that 10 MHz wide satellite after all!

Or do we?

Use of SSB or ACSB would provide for 140 QSO's at 5 KHz spacings and 240 if 2.5 KHz spacings are used in that same 700 KHz wide band! That's between 250-350 users at any given moment.



PHASE IV

POWER REQUIREMENTS

A second consideration, and by no means insignificant, is the average power consumed by stations using the satellite.

FM has a peak-to-average power ratio of 0 dB. That is, the average and peak power of FM is the same.

Standard speech and SSB (since they are nearly identical in nature) have a typical peak-to-average ratio of about 12-18 dB... depending on whose data one chooses.

ACSB of the STI/SEA variety has a peak-to-average ratio of 6 dB.. largely due to the use of a Pilot Carrier.

Level One ACSB without pilot tone and using 2:1 compandoring has a peak to average ratio about 1.8-2.0 dB higher than speech.. about 10-16 dB during speech but better when pauses are averaged into the formula.

The proposed Project OSCAR Level Two ACSB technique which was outlined at the ARRL PACCOMM Convention in San Jose places the normal zero-beat carrier about 7-10 dB below peak speech yielding 6-9 dB peak to average power.

Outlined briefly, Level Two uses the normal SSB carrier by "leaking" it around the crystal filter so that an SSB Reduced Carrier (SSBRC) signal is transmitted. This seems to be the best system to exploit existing circuitry for ACSB transmission.

The only additions to transmit circuitry will then be the pre-emphasis, 2:1 compressor circuits, and whatever circuit is required to "leak" and control the level of the partially re-inserted carrier.

Reception is a bit more complicated but uses Phase Lock Loop circuitry which is totally independant of the transmission path variations and interferences and can use readily available PLL-synthesizer chips.

Either a seperate IF and Crystal Filter is used for AGC and carrier reception or a 2nd IF in the Audio spectrum so that Op Amp filters can be used. I will be publishing further details within the normal magazine lead times, probably in QEX.

Those truly interested in pursuing experimentation along these lines further can write to me through Project OSCAR, 15 Valdez Lane, Watsonville, CA 95076.

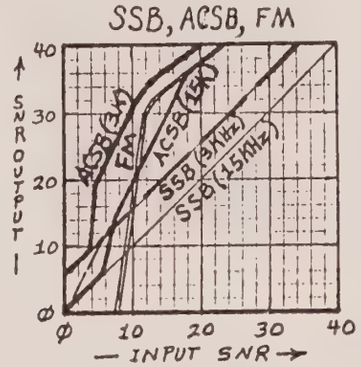
Any way we look at it, FM has a significantly higher power penalty when used on solar powered satellites than any form of SSB would have.

BUT FM SOUNDS BETTER!

It is hard to argue against anyone who suggests that FM provides better fidelity and less noise than standard SSB given a signal level at least 12 dB above the noise level.

Having granted that, it is also hard to argue against anyone who points out that SSB sounds better and is much clearer than FM when the signal level falls below about 8 dB above the noise.

In fact, FM typically becomes unusable at 6-8 dB input SNR!



Consider also that when an FM arrives at 8 dB above the noise in a receiver having the minimum useable bandwidth of 15 KHz, an SSB signal will be arriving at 7.8 dB **better** SNR (10 Log 15/2.5) in its 2.5KHz wide receiver. In other words SSB would produce 15.8 dB SNR at the same power level FM would achieve only 8 dB SNR because of the difference in IF bandwidth required to receive each mode.

FM, on the other hand, would rapidly exceed SSB SNR once either exceeded about 10-12 dB incoming SNR. At 6dB above our 8dB SNR example, or at 14 dB above the receiver noise, the FM signal would be close to "full quieting".

SSB, on the other hand, would have only gone from the 15.8 dB SNR level to 21.8 dB SNR in a linear fashion.

Pre-emphasis and de-emphasis of the SSB signal would improve its recovered SNR by 2-3 dB by reducing post detection noise. Thus we would have 23.8-24.8 dB SNR.

By using ACSB there would be an apparent 20-25 dB SNR improvement due to 1:2 audio expansion. Thus our Level One ACSB or Level Two signal would provide a recovered SNR of 40-50 dB at the same signal level at which FM is also just achieving "full quieting"

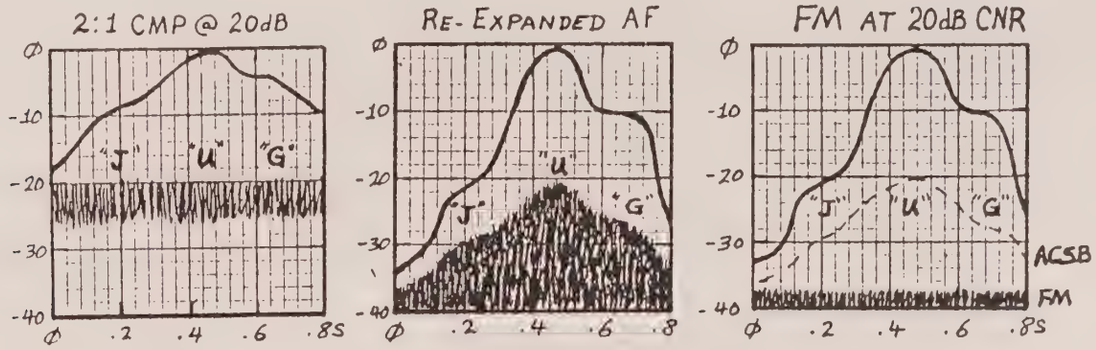
SOUNDS TOO GOOD TO BE TRUE

It is!

In reality, 2:1 ACSB has no better SNR than standard SSB.

Well, it is about 2-3 dB better due to the de-emphasis noise bandwidth reduction, perhaps.

However, since the 1:2 expandor follows the dynamics of the audio, an "apparent" improvement (subjective) will be heard since noise is reduced during non-speech periods and during weaker syllables. During strong syllables the speech itself covers the noise adequately.



To the average ear, the "apparent" SNR will seem to be between 30-50 dB somewhere depending on the type of background noise, the listeners sensitivity to noise, and the nature of the voice and speech being received.

Apparent distortion, on the other hand, will be higher than FM would be at the same SNR. The typical FM transmitter has distortion products falling at or below -30 dB.. roughly 2-3% THD. At an SNR of 30 dB, therefore, we would have possible addition of noise and these distortion products yielding a slight (3 dB) increase in the apparent distortion but still falling below 3-4% THD. Thus would would not hear any distortion on a weaker FM signal since it would be masked by the background noise.

ACSB, however, really has only about 18 dB SNR when its apparent SNR is 30-36 dB. Thus the "distortion" levels, in reality noise, would be at 18 dB.. approximately equivalent to 10% THD.

This is most apparent on the sillibant "s", "ch", and similar sounds and is not unlike the distortion heard on weak FM signals when multipath is present. It is often described as "puffiness", "roughness" or "muddiness".

Put into HI FI terms, at low SNR conditions ACSB doesn't have the "transparency" that FM does. It "colors" the sound more and sounds less like the speaker is in the same room as the listener.

Then again, ACSB is generally considered to have more "punch" under weak signal conditions. This is particularly

true under mobile conditions.

While FM signals often "picket fence", "kerchunk", or have large noise bursts when signals are weak, ACSB under the same conditions will have little "picket fencing" and will have a better SNR than the FM signal. Having said that, the ACSB signal will have some distortion and "quaver" or "uneasiness" caused by slight level variations and selective fading of the signal. There will be no noise bursts such as FM would have.

THE BOTTOM LINE

Given FM or SSB and all the required bandwidth for either mode, 100 FM stations require more peak transponder power than 100 ACSB stations for a given downlink quality.

SSB or 2:1 ACSB have lower average power drain but about the same peak power requirements. FM has better quality at a given SNR, but ACSB yields this SNR at a lower power level.

FM sounds somewhat better at expected downlink SNR levels but ACSB would provide better clarity and more fade margin (FM SNR fades much faster than ACSB).

If care was taken to balance the tonal response of an ACSB and an FM signal arriving at a level which would give 25 dB SNR at the input to the ACSB radio (17 dB CNR in the FM radio), most of us would have a hard time judging which sounded "better". They would sound "different".

ACSB requires newer, different technology and is therefore somewhat more complex for the average station to implement. This is only a short term objection, however.

It is likely that both FM and ACSB will find utilization on Phase IV Satellites, but ACSB should be the primary mode for most utility users.

CAS SYSTEMS

What kind of utility use is likely on a Phase IV satellite?

The Geosynchronous satellite proposed for Phase IV makes an excellent relay system for users located between zero and many thousands of miles from the sub-satellite point of the transponder.

It is, in fact, much better than HF in this regard in that all points visible to the satellite can communicate with each other. There is no "skip zone". Stations inches apart to thousands of miles apart can communicate with each other with the same ease.

A synchronous satellite has no serious variations in signal path conditions so that any time of the day or night, any weather conditions, and any blockages will remain the same at all times.

Once adequate access to the transponder has been established, little variation should be experienced except that due to deterioration of the Ground Station's equipment or satellite transponder loading.

Thus a geosynchronous satellite is excellent for uses requiring long communications periods with no interruptions, coverage of large regions while maintaining local coverage, or "broadcast" activities where information must be deciminated over a large region.

Examples of such uses include emergency communications, public service communications, traffic handling, networks, teleconferences, liaison activities, bulletins, and informational networks such as Westlink.

Other possible uses include remote sensing of widely scattered scientific experiments via communication links through the satellite, expedition communications and telemetry, and teleconferencing for educational or scientific programs. While FCC approval and guidelines must be obtained for these latter activities, there are many potential non-commercial users whose needs cannot be met through commercial satellites both due to the expense of uplink/downlink equipment and/or cost to operate through such transponders.

And, of course, interlinking of repeaters or translators in the Amateur Service could be a major use of a Phase IV transponder.

GETTING THERE

Unlike the movie "Being There" where a complete idiot turned the world of business upside down by just being "in the right place at the right time", Public Service through Amateur Satellites is going to take some dedicated effort.

It won't just "happen"!

First, most public service people I know are more acquainted with the hand-held than with an AZ-EL rotor. Their emphasis is **communications**, not hardware.

Second, the number of us who are technically inclined in the hobby has been, and still is, a minority. In natural disasters one must be able to draw from the **majority** in order for there to be much likelihood that someone is going to be "in the right place at the right time".

Third, it takes more than a hand-held to access a satellite! You can't totally ignore hardware if you wish to communicate most effectively.

My observation with OSCAR 10 is that the minimum requirements for even receiving adequate downlink signals is beyond the capability of the hardware available to the typical VHF user. There is NO way that they can receive Phase III or Phase IV satellites from their cars using the typical 5/8-wave mag-mount whip!

Let's face it, ours is a mobile society where our spare time is largely spent on the road... whether commuting or vacationing.

Thus any Phase IV or advanced Phase III program must recognize this factor.

Furthermore the single family dwelling is rapidly becoming an extinct entity. Perhaps some of us who are senior engineers or who live in the country can afford a house, but the average person in the USA today is living in shared housing of one kind or another. This is especially true in urban centers like the Santa Clara Valley, New York, L.A., or Chicago.

I know of very few Bay Area DX'ers who have not had some kind of run around with neighbors, city, or both about antennas... even OSCAR antennas!

In a word, we will not attract the numbers of Radio Amateurs required to fund a major Phase III or Phase IV project unless we provide some means of satellite access for those whose operations are either predominately mobile or are limited by their housing situation.

COMMUNITY ACCESS STATIONS

I have proposed Community Access Stations as one way of providing better satellite utility for those not able to directly access geosynchronous systems. While some of my QEX article this subject was changed in emphasis by their editing process, it represents a set of possible methods of accessing OSCAR satellites by indirect means.

What was not clearly presented due to the editing is that I feel that certain safeguards should be built in to such systems so that there is no negative impact on current amateur satellite supporter/users.

This is one reason why I am firmly promoting use of ACSB techniques for linking rather than FM. FM links can provide better quality with less complexity but only with unacceptable power and bandwidth penalties.

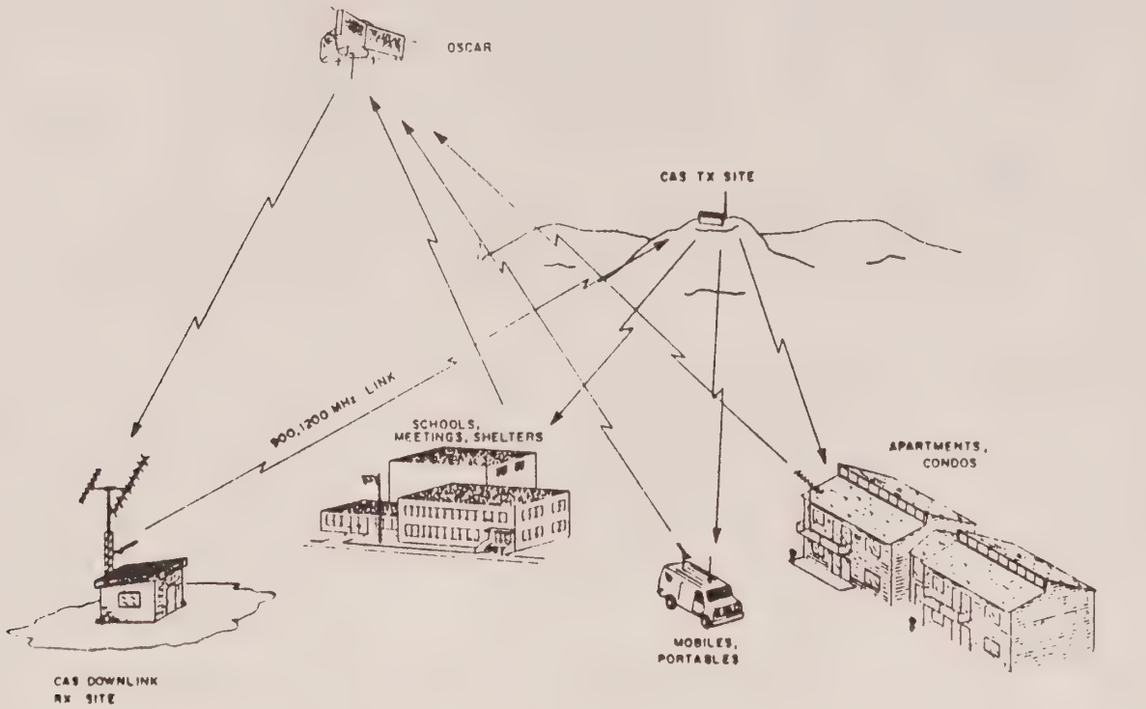
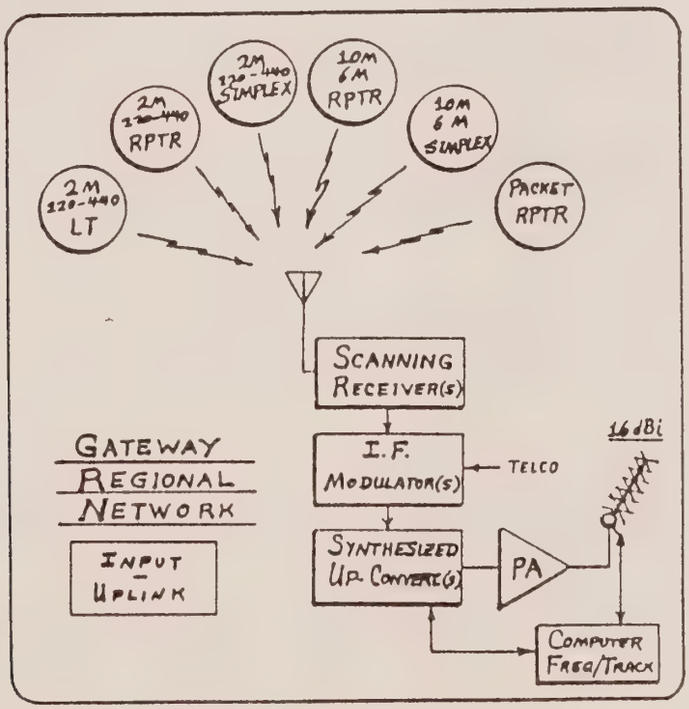


Fig 1—A pictorial of a community access system receive only system.



Summed up, there are three kinds of CAS possible... CASROS, or Community Access Receive Only System; CAS-LT, or CAS Linear Translators; and CAS-MST, CAS Multiple Source Translators.

The CASROS provides a good downlink to stations in a given area so that demonstrations can be given without the hassle dragging around a large Two Meter antenna and so that apartment dwellers, for example, can concentrate on providing a good 435 Uplink signal using the relatively small antenna required rather than putting up the more complex and obvious AZ-EL Two Meter Circular as well.

For the more creative mobile operator, the CASROS provides a usable downlink so that with a 100 W amp and a small antenna he could actually operate mobile through a Phase III or Phase IV bird.

The CAS LT has proven to work well enough through OSCAR 10 so that indirect operation can be obtained either mobile or from a base station. It's limitations, of course, center around control of uplink power and noise, disparity between close in, strong stations and outlying, weaker stations, and the need for a set aside continuous spectrum of whatever bandwidth one wants to cover out of the satellites passband.

None of these are insurmountable problems but there is a better way.

CAS-MST combines the best features of Remote Base, Repeater, and Linear Translator techniques. In essence, a given source station can tune in and work a given destination station through the CAS-MST system.

The source station could be AM, FM, SSB, ACSB or a Repeater, Remote Base, Simplex Access channel (from any mode), a portion of a Linear Translator or even a phone patch set up for this purpose.

The essential element is that the source must be controllable either by Touch-Tone (TM) or some other means of controlling the tuning and functions of the CAS-MST.

If I wanted to use a CAS-MST I would first access either a repeater with CAS capability, a Simplex Remote Base, or a defined portion of a Linear Translator.

I would then use Touch Tones (TM) or some other control means to access the CAS system.

At this point I would begin to hear a portion of the satellite downlink signal. Probably the default condition would be that the system would come up tuned to the beacon. That way the I can go through a brief process of "zero

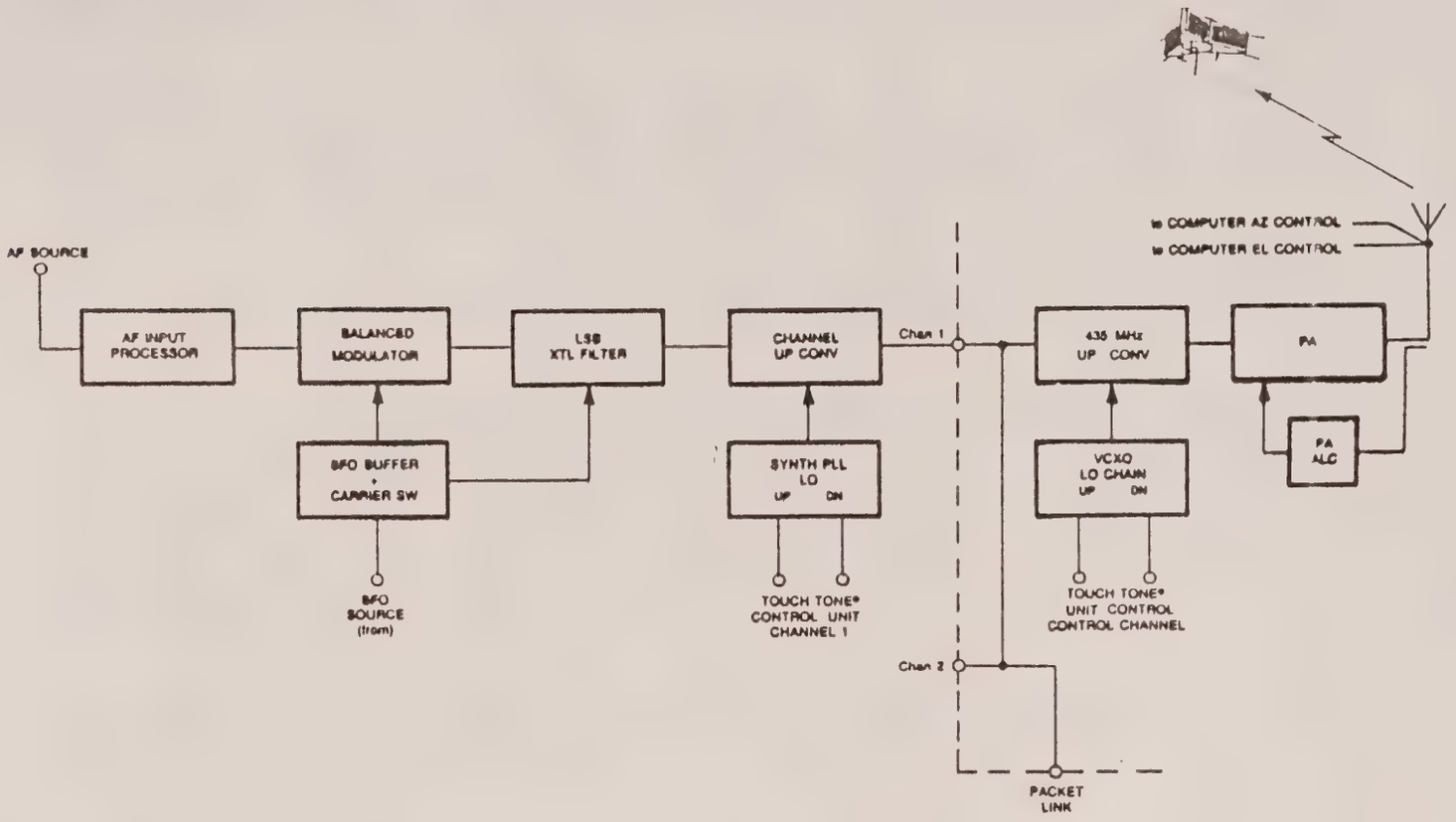


Fig 3—A block diagram of the CAS uplink transmitting station.

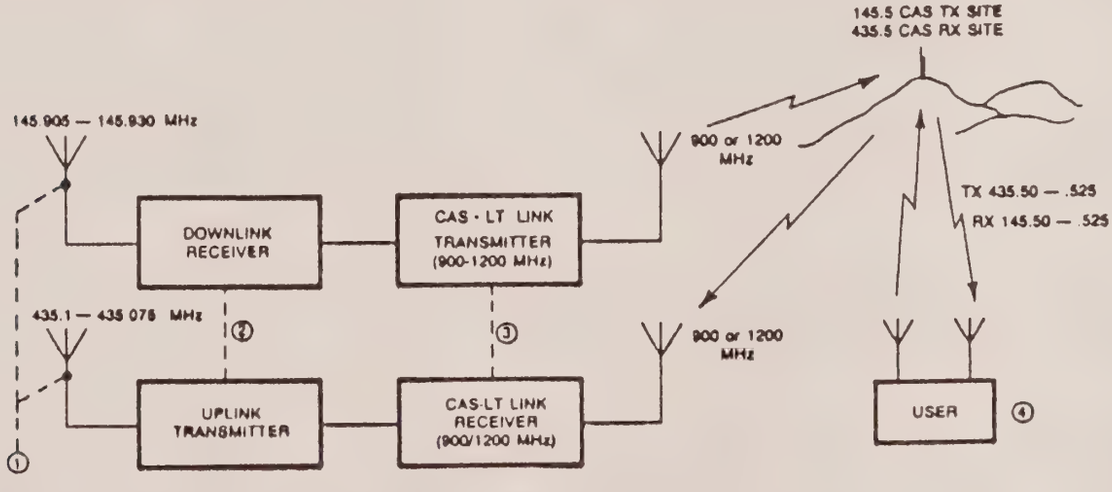


Fig 4—The CAS-LT block diagram. At location 1, the required hardware for az-el tracking includes a 2-m and/or 70-cm beams, az-el rotators, and a computer or remote controller. Location 2 features frequency tracking. The system should be remotely or automatically adjusted to perform its responsibilities. A link system is shown at location 3. It consists of two channels, a separate transmitter and receiver and separate antennas or diplexed.

beating" the beacon by hitting "#" for "up" and "*" for down, for example, then I would key in a sequence, say "5-50" or "5-70" to tune the CAS-MST IF Subsystem 50 or 70 KHz up from the beacon to the area of activity I am interested in tuning.

Now all I need to do is to use the "up"/"down" "#" or "*" keys to tune in a station I wish to talk to then key in the appropriate access code to initiate transceive operation. That code could be, say, 7-1-1.

The CAS-MST is designed to automatically track any Doppler Shift (for Phase II or III satellites) and adjust for uplink and downlink system drifts.

This is not as difficult to achieve as one might think. If everything is synthesized and/or digitally adjustable and all operations are referenced to the beacon frequency, the ACTUAL uplink and downlink frequencies will not matter. Even though they will be different for stations located in New York City and San Francisco, their relationship to the beacon will always be the same.

The technique DOES require that a beacon carrier be present at all times, however, slightly impacting the satellite design. This is not that difficult to provide, however.

Using beacon reference provides one other kind of operation that is challenging. If a set of "channels" are set aside at beacon + 750KHz, 752.5KHz...760KHz (5 channels), participating repeaters, remote bases, or linear translators could access each other by dialing up an interconnect and destination code (say, 825 #25) to bring up any desired machine on the system. The CAS-MST would then check the other four "working channels" to see which one was available then both machines would switch to that "channel" to complete the QSO and leave the calling channel free.

Obviously some means of access control between machines would need to be established and the CAS-MST in each instance would need to be able to ensure proper operation of its linked system.

Project OSCAR has set aside significant funding to develop the various modules required to accomplish this kind of system. We will use whatever commercial equipment that can easily be applied to the problem and develop the specialized hardware.

Obviously in the absence of OSCAR 10 we will use terrestrial linking and, possibly, FO-12 for our evaluations. We will publish results as time goes on.

If you have experience in synthesizer design in the 50

MHz region, in Touch Tone (TM) control circuitry, or other areas you think might be of use to us, please feel free to contact me at the address given earlier.

JAS-1 Information from JARL (19)

More than half a year has passed since the launch of JAS-1. This is an information of present status of JAS-1 operation.

Digital system, or JD, is now building up to operate as a mail box. Because of power budget that is not enough for JD to operate continuously, it is necessasry for JAS-1 to be provided the function of self-control that enables to turn JTD on and off according to the program, or the decision by measured data of power subsystem. This will make possible to operate JD system safely even in region where the control from our TTC station does not reach.

Temporary schedule for digital mode operation of JAS-1 is as follows:

1. Function of self-controlling of power system and transponder JTD has been provided for the digital system to operate JAS-1 in safety, and also to turn JTD on and off alternately so that all users in the world can try looping-back of their own test signals.

At present, JD opens every other day, and transmitter JTD sends signals for 5 minutes at 5 minutes interval, namely 50% of duty factor. This cycle lasts for 2 hours at 2 hours interval, through one day, so the whole duty factor of JTD becomes 25%. We are trying to operate JD on Saturday and Sunday as possible.

2. Present function of JD is **to repeat digital signals in real time.** When you call JAS-1 (its call-sign is 8J1JAS), it will re-transmit the same data frames as that of your uplink. Also you can connect to other station **through** JAS-1. These signals are transmitted inserting between telemetry data always sent periodically.

3. Verification of processing with AX.25

After the confirmation of long-term operation of self-control, digipeating after AX.25 will start for all users to practice communications.

4. Mail box

After AX.25 processing verification, programs are then loaded to the satellite and this work will progress through March.

Notice:

Operation of mode JA may be much affected during these period owing to works for digital system and resulted power limitation. We are to operate JA and JD alternately at every week interval during these period, with some possibilities of changing schedule.

We will tell you the opening of mailbox after its completion, also with operation schedule.

Commands of mailbox are similar to those of terrestrial networks. Commands are shown in attached paper.

March 9th, 1987

Fujio Yamashita, JS1UKR
Tech. Labo.
J A R L

------JAS-1 Information of Mailbox Command------

Mail box of JAS-1 digital system will be available soon, and this is the command information for its use. Operation schedule of the digital system will be changeable in the beginning phase of the digital operation, due to additional work to modify the system.

JAS-1 Packet BBS User Interface Information
*** Mail Box Commands (Basic users training) ***

1. Summary

1.1 Available commands

F:List files addressed to ALL or to current user,
H : Help,
K : Kill file(s),
M : List file(s) to/from current user,
R : Read file(s),
W : Write file.

1.2 Command syntax

The general format is: **<a command letter> <space> <argument>**. At least one blank is required between **<a command letter>** and **<argument>**.

2. Command Prompt

JAS-1 Mailbox supplies a prompt "JAS>" with no CR nor LF to indicate that the system is ready to accept a command from the user. A user can type ahead commands while JAS-1 is sending messages or data to the user. JAS-1 will execute the commands in the waiting queue later.

3. Commands

3.1 **F** command

F is FILES. This shows the latest 10 files the first time it is entered during a session. Subsequent **F** command will list the next 10 active files (messages). A message posted to multiple users has "*" in its "To:" destination field. See also the "**M**" command described below.

Example:

```
JAS>F
No.  Date   From    To      Subject
117  10/12  F8ZS    ALL     ARSENE update
116  10/12  DL3AH   ALL     Abgleichanleitung
                            der AFREG
114  10/11  JA1RL   ALL     JAS-1 new schedule
113  10/11  WA2LQQ  ALL     ALINS for Phase-3C
112  10/10  JA1DSI  ALL    WHO MANAGES HKOXX QSL?
111  10/10  G3AAJ   *       Harry in London
110  10/09  WORPK   ALL     P3C countdown #8
107  10/09  9M2CR   ALL     NMCR AMTOR MAILBOX
                            NOW QRV
103  10/09  JR1FIG  JA9BOH  Uchiawase wa raishuu?
102  10/09  N7FDA   *       RS-232C card for PCC-
                            1089

JAS>F
101  10/09  G3RUH   ALL     New software for BBS
100  10/08  JR1ING  JR1FIG  Sarani kogata no TNC
 99  . . . . .
 98  . . . . .
 96  . . . . .
 95  10/08  N5AHD   JR1FIG  Automatic tracking
                            system
 94  . . . . .
 93  . . . . .
 92  10/07  DB2OS   ALL     RUDAK - Statusreport
 85  10/07  5H3KK   ALL     Now QRV on JAS-1
```

3.2 **R <file#1>, <file#2>, ... ,<file#8>**

R means READ. This requests to JAS-1 to send file(s) (messages) specified by file number(s) you got from the "**F**" command. Up to eight files can be specified.

Example:

```
JAS>R 95,102

Posted: 86/10/08  17:33 UTC
From:   N5AHD
To:     JR1FIG
Subj:   Automatic tracking system
 ..............................
 ..........message.............
 ..............................
73, R. J. Diersing, N5AHD

Posted: 86/10/09 03:21:42 UTC
From:   N7FDA
To:     JR1FIG, JA1JHF
Subj:   RS-232C card for PC-1089
 ..............................
 ..........message.............
 ..............................
```

- -

3.3 **W (call1, call2, ... ,call8)**

W is WRITE, to send a message (file) to others. As many as eight destination addresses can be specified. The part of the command line in brackets **(call1, call2, ...)** is optional. A message without specific destination is for "public", i.e. addressed to "ALL".

The JAS-1 mailbox will then prompt you to send the subject field by sending "Subj:". You can send a subject field with up to a 32 character string. After receiving the "Text:" prompt, you enter the message text, ending each line with **<cr>** (carriage return). You terminate with either

<cr>.<cr>, or **<cr> <ctl-Z> <cr>**.

(i.e., a line containing only a period or a control-Z) to the indicate end of your text.

Example:

```
JAS>W N7FDA
Subj: Roger, wait for a while.
Text:
 ..............................
 ............message.............
 ..............................
^Z
```

3.4 **K<file#1>, <file#2>, ..., <file#8>**

K is KILL and deletes file(s) (message) specified by file numbers. The <file#> is the same one described in R command. Up to eight files can be specified in a command line. A user can only delete filesaddressed solely to himself (i.e., not to multiple users) or files he posted.

- -

3.5 **H**

H = HELP. Entering **H <cmd>** gives additional information on that command. Entering only **H** will give a list of all available commands.

- -

3.6 **M**

M is MINE, this requests to send the latest 10 files (messages) that are either to or from the current user. Additional M commands list additional active messages. This command will be useful to save channel time when the user only wants to see his messages.
Example:

```
JAS>M
NO.  DATE   FROM    TO      SUBJECT
111  10/10  G3AAJ   *       Harry in London
103  10/09  JR1FIG  JA9BOH  Uchiawase wa
                            raishuu?
102  10/09  N7FDA   *       RS-232C card for PC-
                            1089
100  10/08  JR1ING  JR1FIG  Sarani kogata no TNC
 95  10/08  N5AHD   JR1FIG  Automatic tracking
                            system
```

THE AMERICAN RADIO RELAY LEAGUE, INC.
INTERNATIONAL SECRETARIAT OF THE INTERNATIONAL AMATEUR RADIO UNION
ADMINISTRATIVE HEADQUARTERS NEWINGTON, CONNECTICUT

LARRY E. PRICE
JAY A. HOLLADAY
LEONARD M. NATHANSON
WILLIAM J. STEVENS
DAVID SUMNER
JAMES E. McCOBB
QST

February 13, 1987

ARRL AD HOC COMMITTEE ON AMATEUR RADIO DIGITAL COMMUNICATION

Gentlemen:

This has been a hectic two weeks at ARRL HQ because of FCC releases. The principal one was action on the long-awaited Novice Enhancement petition. Enclosure A is a copy of PR Docket No. 86-161 Report and Order, which among other things gives Novices digital privileges in the 10-, 1.25- and 0.23-meter bands and raises issues this Committee will need to discuss.

In the true spirit of "giveth and taketh away," the FCC yesterday released their Notice of Proposed Rule Making under PR Docket No. 87-14, which would deallocate the 220-222 MHz band from the Amateur Service. See Enclosure B. Were this to happen, our general plans for =>9600-baud packet operation in 220-222 MHz would be killed, and other amateur operations in this band would be disenfranchised. The ARRL Executive Committee will be considering a draft that vigorously opposes this NPRM at its March 21 ARRL meeting. Comments are due by April 6, and reply comments by April 21.

There are numerous other items that I need to communicate to you, but I felt it desirable to see that you have the full texts of these FCC releases and an advance copy of the January Board Minutes (Enclosure C) without further delay.

We need to schedule an early meeting time that is possible for all or most Committee members. Please complete Enclosure D and return it to me ASAP in the envelope provided.

73,

Paul L. Rinaldo, W4RI
Chairman

Enclosures:
A. PR Docket No. 86-161 R&O
B. PR Docket No. 87-14 NPRM
C. Board Minutes
D. Meeting questionnaire
E. Business reply envelope

Before the
Federal Communications Commission
Washington, D.C. 20554

PR Docket No. 86-161

In the Matter of

Amendment of the Amateur	RM-5022 RM-5038
Radio Service Rules to	RM-5023 RM-5251
Expand the Privileges	RM-5024 RM-5281
Available to Novice Operators	RM-5025 RM-5282

REPORT AND ORDER
(Proceeding Terminated)

Adopted: January 28, 1987 **Released: February 10, 1987**

By the Commission:

INTRODUCTION

1. On April 18, 1986, in response to several petitions for rule making, we adopted a *Notice of Proposed Rule Making* (51 FR 17074; May 8, 1986) *(Notice)* proposing to enhance the privileges authorized by the Novice amateur operator license. The enhanced privileges would be in the HF 10 meter,[1] VHF 1.25 meter, and UHF 0.23 meter bands with transmitter peak envelope power maximums of 200 watts, 25 watts, and 5 watts respectively. We proposed all authorized emission modes[2] for the VHF and UHF bands and emissions A1A, F1B and J3E for the HF subband. We also requested information on related issues including the number of questions appropriate for the Novice operator written examination, the number of volunteer examiners (VE's) required to properly administer a Novice operator examination, and whether a better balance between the requirements and privileges of the Technician operator license would be helpful. More than 350 comments were filed, including four reply comments.

2. The proposed enhanced Novice class privileges were intended to create a greater desire in new entrants into amateur radio to stay with the hobby and advance through its five-tier licensing structure. In this way, the licensing structure would become more responsive to the needs and desires of the amateur community. The other proposals and questions were generally related to the increase in Novice privileges or to the basic licensing procedures.

COMMENTS

3. More than 80% of the commenters supported the proposal. They believed that enhanced Novice operator privileges would attract and retain more persons in the service. In addition, manufacturers and distributors of amateur radio equipment said they hoped it would curb the loss of operators and consequent declining sales of equipment.[3] The major concern in the comments was that excessive privileges could diminish the incentive for Novice operators to upgrade to a higher operator license. Also objected to was authorizing present Novice and Technician operator licensees[4] any additional privileges without requiring them to qualify by further examination.

4. The comments favored expanding Novice operator HF 10 meter privileges to 28.1-28.5 MHz. The International Beacon Project, the International Amateur Radio Union and other commenters were concerned that such an expansion could jeopardize the usefulness of the amateur beacon system. They believed that amateur stations in other countries would be driven to transmit on beacon system frequencies in order to avoid congestion caused by an influx of stations with Novice and Technician control operators. The American Radio Relay League, Inc. (ARRL) stated, however, that amateur operators traditionally observe voluntary operating restrictions when necessary for the protection of universally beneficial operations like the beacon system.

5. The Notice of Proposed Rule Making in this proceeding proposed that Novice control operators be authorized privileges in the entire VHF 1.25 meter band. The comments generally supported this proposal because it would provide a common meeting ground for new amateur operators to meet experienced operators. In commenting on our statement[5] that we will not finalize this aspect until certain related allocation matters for the 216-225 MHz band are resolved, ARRL said that this proceeding has no connection with frequency allocation decisions. It stated that the inclusion of Novice operator privileges on a band already available to the Amateur service would not affect future allocation revisions.

6. Richard S. Moseson and other commenters pointed out that the proposed UHF 0.23 meter Novice operator privileges were not in keeping with the ARRL voluntary band plan. In its reply comments, ARRL acknowledged the discrepancy and requested the subband be at 1270-1295 MHz where repeater operation is conducted. Also mentioned in the comments was a potential biological hazard to the operator of a station transmitting in this frequency range.[6]

7. The comments favored all emission modes in the VHF and UHF bands so Novice operators could communicate using modern technology. Dissatisfaction with the telegraphy-only privileges was blamed as a major cause of Novice operators dropping out of the Amateur service. Although most commenters favored limiting Novice operators to emissions A1A, F1B and J3E in the 10 meter subband, a few commenters urged authorization of emission A3E. Still other commenters considered any HF emission privileges for Novice operators beyond A1A as a disincentive to upgrading. In its reply comments, ARRL said that enhanced privileges in the limited frequency bands proposed would operate as an incentive for Novice operators to upgrade. About 5% of the commenters were apprehensive that Novice operator telephony privileges in the 10 meter band could attract unlawful operators from the nearby 11 meter band.

8. Novice operators were asked to comment on the proposal to limit their stations to low transmitter power while higher class operators could transmit on the same frequencies with high power. The comments stated that this would place Novice operated low power stations at a distinct disadvantage. It was also suggested that all stations transmitting on the Novice subbands be restricted to low power. It was noted that higher class operators would lose existing privileges if this approach were taken.

9. The comments generally concurred that the topics on the Novice operator written examination should correspond to the privileges authorized. They favored increasing examination Element 2 to 30 questions or even to 50 questions. The repeated concern was that Element 2 should not be so difficult as to discourage newcomers.

10. Twenty-one percent of the comments discussed ARRL's request for two administering volunteer examiners (VEs).[7] Some 9% of the comments stated that the one-VE requirement should be continued because it is more convenient and less stressful for beginners. About 5% of the comments, including the ARRL's, disagreed and said that enhanced privileges for Novice operators necessitated a second administering VE to minimize the likelihood of examination fraud. Another 7% of the comments recommended that the examinations be prepared and administered under the volunteer-examiner coordinator (VEC) System. ARRL opposed this approach because it would increase the burden on the VEC System and reduce the availability of examinations.

11. Comments were requested on confining the written examination for the Technician operator license to the privileges authorized by that license.[8] Gordon West, an amateur operator instructor, stated that such a change would allow instructors to train students preparing for the Technician operator license more thoroughly in relevant VHF and UHF topics. Another viewpoint expressed in the comments was that another examination element would complicate the examination process.

DISCUSSION

12. The prospect of enhanced privileges for Novice operators has already stimulated growth in the service. In FY 1986, nearly 21,000 new persons entered the Amateur service, an increase of 20.75% over FY 1985. More than 19,000 became Novice operators. Furthermore, the number of licensees dropping out of the Amateur

service decreased by 15.13% during the same period. We believe these are clear indicators that changes in the entry level license are appropriate.

13. In its proposal regarding the 1.25 meter band (VHF), the ARRL requested that Novices be permitted use of the band 220-225 MHz with all voice and data modes, including radiotelegraphy, with a power limit of 25 watts output. However, it asked that repeater operation by stations licensed or controlled by Novices not be permitted, i.e., a Novice signal could be retransmitted by a repeater, but a Novice operator could not sponsor or be the trustee of one. The comments reflected an interest in VHF privileges for Novice operators. In our view, VHF privileges for Novices would create the kind of interest that is needed for amateurs to continue in the hobby and at the same time motivate them to advance to the higher license classes. To this end, we will authorize frequencies 222.10-223.91 MHz for use by Novice operators. This action in conjunction with voluntary band plans will allow operation on repeater input and simplex channels. Novices may not be licensees, control operators or trustees of the repeaters.[9] This would permit Novice operators to operate with those modes most appropriate to their level of license and to communicate with more experienced amateurs. For example, frequencies below 222 MHz are typically used for moonbounce, propagation beacons and control signals, activities generally engaged in by amateurs with more experience.

14. We agree with the commenters that the UHF 0.23 meter subband should be on 1270-1295 MHz to allow Novice operators to gain experience with repeater operation. Low transmitter power and incorporation of suitable safety precaution information in the amateur radio practices examination topics[10] should assure that Novice operators will not endanger themselves. Thus, we will authorize the subband at 1270-1295 MHz, as requested.

15. The prospect of interference to the 10 meter beacon system expressed in the comments is speculative and may never become a concern, given the record of amateur operators in adhering to voluntary arrangements. Moreover, the low power limit proposed for stations with Novice control operators should satisfy this concern. Thus, it does not afford a reason not to go forward.

16. It is evident from the comments that more emission modes will attract more Novice operators to the Amateur service. However, the frequency ranges in which to use them should provide the proper degree of enhancement so that Novice operators would still have an incentive to upgrade to higher operator licenses. Thus, digital and limited telephony privileges in the 10 meter band appear appropriate and will be authorized.

17. We continue to believe in power restrictions for Novice sections in the new bands. The restrictions will add a further incentive to upgrade the class of license. Also, because of the lesser experience level, Novice operators are more likely unintentionally to cause interference. Reduced power levels will help limit the extent of any interference.

18. When the privileges of any operator license class are modified, the qualification requirements should be revised accordingly.[11] The Novice operator license written examination, Element 2, is based upon telegraphy station operation. We believe the examination should be broadened in scope, commensurate with enhanced Novice operator privileges. We shall therefore require an additional 10 questions, for a total of 30, to make the scope of Element 2 appropriate to the new privileges, without creating a significant deterrent to potential Novice operator examinees.

19. We will adopt rules so that two VEs will prepare and administer Novice operator examinations. Although there may be isolated areas where locating two VEs may be difficult, the added safeguard would be justified. There are legal and practical problems which prevent placing Novice operator examinations under the VEC System.[12] Additionally, to incorporate this work into the VEC system would nearly double the workload and expense for the volunteers operating that system. We will accordingly adopt the two VE procedure and reflect that requirement in a revised Form 610, Application for Amateur Radio Station and/or Operator License.

20. In a related issue, Novice operators may not be upgrading to Technician operator because the content of Element 3 requires them to also be knowledgeable about General class operator privileges. This is the only instance in the operator license progression where the applicant must not only know the material for the operator privileges that will be authorized at the next step (Technician), but also must know the material for the next higher step (General). To require any applicant to be knowledgeable about privileges which the license does not authorize is inconsistent and a burden upon applicants, administering VEs, and instructors. To resolve this problem, we will separate Element 3 into two parts. Technician operator questions will be placed into an Element 3(A) VEC question pool and General class questions will be placed into an Element 3(B) VEC question pool. It would be timely to take this action at this juncture for two reasons. First, the VEC's will have to revise Element 3 as a result of this action in order to move certain of its questions to Element 2 in conjunction with enhanced Novice operator privileges. Therefore, they could concurrently divide the remaining Element 3 questions into an Element 3(A) and an Element 3(B) as appropriate. Second, the application form is being revised in order to incorporate provisions for Novice operator examination certification by two administering VEs. It could be concurrently revised to include marking boxes for Element 3(A) and for Element 3(B).

OTHER ISSUES

21. All present Novice and Technician operators will be authorized the new privileges without additional qualification. However, we strongly recommend that present Novice operator licensees become knowledgeable in the new requirements before using their new privileges. For example, they should study the material in new Element 2 that relates to the enhanced Novice operator privileges even though we will not require that they be examined on it. As to present Technician operators, any examinee holding such a license issued before the effective date of these rule amendments will be given examination credit for Elements 1A, 2, 3(A), and 3(B).

22. FCC Form 610 is currently being revised in connection with rule amendments pertaining to allowing credit to examinees for certain previously-passed written examinations.[13] Those revisions and the revisions required by the action taken in this proceeding are being simultaneously incorporated into the form. Upon receipt of Office of Management and Budget (OMB) approval of FCC Form 610, we will issue a Public Notice with a draft sample of the form attached. The modified FCC Form 610 will provide for certification by two administering VEs for the Novice VE System and for a revised Administering VE's Report.

23. The new rules adopted herein have been analyzed with respect to the Paperwork Reduction Act of 1980 and found to impose a modified information collection requirement on the public. Burden hours imposed on the public will not increase or decrease.

24. Pursuant to 5 U.S.C. §604, we submit this final regulatory flexibility analysis. We are enhancing the Novice operator license by authorizing privileges in the 10 meter, 1.25 and 0.23 meter bands. We expect that at least 21,000 persons each year will become Novice operators. This should have a positive effect on the sale of amateur radio equipment. The only changes made from our proposal were that the UHF frequencies are being revised, the number of VEs required to prepare and administer examinations in the Novice VE System is being increased to two and examination Element 3 is being restructured. No other alternatives to the proposal were considered except to maintain the *status quo*.

25. A copy of this Report and Order will be served on the Chief Counsel for Advocacy of the Small Business Administration.

26. IT IS ORDERED, That Part 97 is amended as set forth in the Appendix hereto. This action is taken pursuant to the authority contained in Sections 4(i) and 303(c) and (r) of the Communications Act of 1934, as amended.

27. IT IS FURTHER ORDERED, That these rule amendments shall become effective 0001 UTC March 21, 1987.

28. IT IS FURTHER ORDERED, That this proceeding is terminated.

29. For information concerning this proceeding, contact Maurice J. DePont, Federal Communications Commission, Private Radio Bureau, Washington, D.C. 20554. (202) 632-4964.

FEDERAL COMMUNICATIONS COMMISSION

William J. Tricarico
Secretary

APPENDIX

Part 97 of Chapter 1 of Title 47 of the Code of Federal Regulations is amended, as follows:

1. The authority citation for Part 97 continues to read, as follows:

Authority citation: 48 Stat. 1066, 1082, as amended; 47 U.S.C. 154, 303. Interpret or apply 48 Stat. 1064-1068, 1081-1105, as amended; 47 U.S.C. 151-155, 301-609, unless otherwise noted.

2. Section 97.7(a) is revised, as follows. The line entry for the 10-meter band is revised to read as shown below. Following the kilohertz listing, a megahertz listing for the 1.25 and 0.23-meter bands is added.

§97.7 Frequency privileges.

* * * * *

(a) *Novice class:*

Meter Band	Terrestrial location of the amateur radio station			Limitations see para (g)
	ITU Region 1	ITU Region 2	ITU Region 3	
		kilohertz		
		* * * * *		
10	28100-28500	28100-28500	28100-28500	1
		megahertz		
1.25	----------	222.1-223.91	----------	5
0.23	1270-1295	1270-1295	1270-1295	5, 22
		* * * * *		

3. In Section 97.7(b), the line entry for the 10-meter band is revised to read:

§97.7 Frequency privileges.

* * * * *

(b)***

Meter Band	Terrestrial location of the amateur radio station			Limitations see para (g)
	ITU Region 1	ITU Region 2	ITU Region 3	
		* * * * *		
10	28100-28500	28100-28500	28100-28500	1
		* * * * *		

4. Section 97.7(g)(1) is revised to read, as follows:

§97.7 Frequency privileges.

* * * * *

(g) *Limitations:*

(1) Control operators holding the Novice or Technician class operator license are limited to international Morse code when the station is transmitting emission A1A in the 80, 40, 15 and 10 meter bands.

* * * * *

5. In Section 97.21, paragraphs (c) and (d) are revised to read, as follows:

§97.21 Examination elements and standards.

* * * * *

(c) A written examination shall be such as to prove that a person possesses the operational and technical qualifications required to perform properly the duties of an amateur radio licensee. Each written examination shall be comprised of a question set, as follows:

(1) Element 2: At least 30 questions concerning the privileges of Novice class licensees;

(2) Element 3(A): At least 25 questions concerning the additional privileges of Technician class licensees;

(3) Element (3B): At least 25 questions concerning the additional privileges of General class licensees;

(4) Element 4(A): At least 50 questions concerning the additional privileges of Advanced class licensees;

(5) Element 4(B): At least 40 questions concerning the additional privileges of Amateur Extra class licensees;

(d) The topics and percentage of questions in each question set shall be that listed for the appropriate examination element.

		Elements				
	Topic	2	3(A)	3(B)	4(A)	4(B)
(1)	Federal Communications Commission's Rules for the Amateur Radio service	35%	20%	16%	12%	20%
(2)	Amateur station operating procedures	5%	12%	12%	2%	10%
(3)	Radio wave propagation characteristics of amateur frequency bands	5%	12%	12%	4%	5%
(4)	Amateur Radio Practices	15%	16%	20%	8%	10%
(5)	Electrical principles as applied to amateur station equipment	15%	8%	8%	20%	15%
(6)	Amateur station equipment circuit components	5%	8%	4%	12%	10%
(7)	Practical circuits employed in amateur station equipment	5%	4%	4%	20%	10%
(8)	Signals and emissions transmitted by amateur stations	5%	8%	8%	12%	10%
(9)	Amateur station antennas and feed lines	10%	12%	16%	10%	10%

6. Section 97.23 is revised to read, as follows:

§97.23 Examination requirements.

Applicants for operator licenses will be required to pass the following examination elements;

(a) Amateur Extra: Elements 1(C), 2, 3(A), 3(B), 4(A) and 4(B);
(b) Advanced: Elements 1(B), 2, 3(A), 3(B) and 4(A);
(c) General: Elements 1(B), 2, 3(A) and 3(B);
(d) Technician: Elements 1(A), 2 and 3(A);
(e) Novice: Elements 1(A) and 2.

7. In Section 97.25 paragraph (a) is revised and a new paragraph (e) is added to read, as follows:

§97.25 Examination credit.

(a) An applicant for a higher class of amateur operator license who holds a valid amateur operator license issued by the Federal Communications Commission will be given credit, as follows:

(1) Novice: Elements 1(A) and 2;
(2) Technician: Elements 1(A), 2 and 3(A)
(3) General: Elements 1(B), 2, 3(A) and 3(B);
(4) Advanced: Elements 1(B), 2, 3(A), 3(B) and 4(A).

* * * * *

(e) An applicant holding a Technician operator license issued before (effective date of these rules) will be given credit for Elements 1(A), 2, 3(A) and 3(B).

8. In Section 97.28, paragraphs (a) and (b) are revised to read, as follows:

§97.28 Examination administration.

(a) Unless otherwise prescribed by the Federal Communications Commission, each examination for an amateur radio operator license (except the Novice operator license) shall be administered by three accredited (see §97.515) volunteer examiners. A volunteer examiner administering element 1(A) or element 2 (in conjunction with an examination other than a Novice operator examination), or element 3(A), must hold an Amateur Extra or Advanced radio operator license issued by the Federal Communications Commission. A volunteer examiner administering element 1(B), element 1(C), element 3(B), element 4(A), or element 4(B) must hold an Amateur Extra operator license issued by the Federal Communications Commission.

(b) Unless otherwise prescribed by the Federal Communications Commission, each examination for a Novice operator license shall be administered by two volunteer examiners. The volunteer examiners do not have to be accredited. The volunteer examiners must hold current General, Advanced or Amateur Extra operator licenses issued by the Federal Communications Commission.

* * * * *

9. Section 97.61 (a) is amended by adding a new line entry before 28000-28300 kHz, by removing limitation 1 from the line entry for 28000-28300 kHz, by adding a new limitation 3 in the line entry for 28300-29500 kHz, and by deleting line entry 28300-29700 kHz and substituting therefor line entry 29500-29700 kHz.

§97.61 Authorized emissions.

(a) *kilohertz:*

Frequency kHz	Emissions	Limitations see para. (d)
	* * * * *	
28000-29700	A1A	
28000-28300	A1A, F1B	
28300-29500	A1A, A3E, F3E, G3E, A3C, F3C, A3F, F3F, H3E, J3E, R3E	3
29500-29700	A1A, A3E, F2A, F3E, G3E, A3C, F3C, A3F, F3F, H3E, J3E, R3E	
	* * * * *	

10. Section 97.61(d) is amended to add a new limitation (3), as follows:

§97.61 Authorized emissions.

* * * * *

(d) * * *

(1) * * *

(2) * * *

(3) A station with a Novice or Technician control operator is authorized to transmit only emissions A1A and J3E in this subband.

11. Section 97.67 is revised by changing subparagraph (6) of paragraph (d) and by adding new paragraphs (j) and (k) as follows:

§97.67 Maximum transmitting power.

* * * * *

(d) * * *

(e) 28100-28500 kHz when the control operator holds a Novice or Technician class operator license.

* * * * *

(j) The transmitter power of each amateur station at which the control operator holds a Novice class operator license shall not exceed 25 watts peak envelope power when transmitting in the 1.25 meter band.

(k) The transmitter power of each amateur station at which the control operator holds a Novice class operator license shall not exceed 5 watts peak envelope power when transmitting in the 0.23 meter band.

12. Section 97.85 is amended by adding a new paragraph (i) as follows:

§97.85 Repeater operation.

* * * * *

(i) No amateur station at which the control operator or station licensee holds a Novice class operator license shall be in repeater operation.

13. Section 97.86 is amended by adding a new paragraph (e), as follows:

§97.86 Auxiliary operation.

* * * * *

(e) No amateur station at which the control operator or station licensee holds a Novice class operator license shall be in auxiliary operation.

14. Section 97.87 is amended by adding a new paragraph (f), as follows:

§97.87 Beacon operation.

* * * * *

(f) No amateur station at which the control operator or station licensee holds a Novice class operator license shall be in beacon operation.

FOOTNOTES

[1]Since each operator license class is authorized all privileges of the next lower class, Technician operators would also benefit from increased HF privileges to Novice operators.

[2]See 47 CFR §97.61(c).

[3]Icom America, Inc., Advanced Computer Controls, Inc., Palomar Engineers and Universal Amateur Radio, Inc. filed comments.

[4]There were 78,986 Novice operator licensees and 85,495 Technician operator licensees as of October 31, 1986.

[5]*See Notice of Proposed Rule Making* in this Docket, paragraph 15.

[6]FCC proceedings concerning standards to deal with the biological effects of human absorption of radio frequency radiation are in progress. See Report and Order, adopted February 26, 1985, in Gen. Docket No. 79-144; FCC 85-90; 50 FR 11151, March 20, 1985. See also Further Notice of Proposed Rule Making in the same docket, adopted February 26, 1985; FCC 85-91; 50 FR 10814, March 18, 1985.

[7]A discussion of this matter was requested. See Notice of Proposed Rule Making in this Docket, paragraph 16.

[8]The Novice operator must pass written Element 3 to upgrade to the next step Technician operator license. Element 3 consists of topics relating both to the Technician operator and the higher General operator licenses.

[9]We have chosen the frequency subband 222.10-223.91 MHz based on the voluntary band plan now under review by the ARRL. For example, we are aware of a similar band plan used by 220 Spectrum Management Association of Southern California with repeater output frequencies beginning at 223.62 MHz. Our reason for selecting this band is to provide Novice operators access to repeater communications by permitting them to operate on repeater input frequencies. Where voluntary band plans identify repeater output frequencies inside the subband 222.10-223.91 MHz, this circumstance is not to be construed as authority for repeater operation (see §97.85) by Novice class licensees.

[10]See 47 CFR §97.21(d).

[11]The FCC may prescribe the qualifications of operators, classify them according to the duties to be performed, and issue licenses to qualified persons. See Section 303(*l*)(1) of the Communications Act of 1934, as amended.

[12]The legislation which permitted reimbursement of expenses was not to have any adverse effect upon the Novice operator system. See Footnote 2, *Notice of Proposed Rule Making,* adopted March 6, 1968, in PR Docket No. 84-265; FCC 84-75; 49 FR 10316, March 20, 1984.

[13]See Report and Order, PR Docket No. 86-63; FCC 86-429; adopted October 6, 1986; 51 FR 42576, November 25, 1986.

Moved and Seconded . . .

MINUTES OF THE 1987 ANNUAL MEETING OF THE BOARD OF DIRECTORS THE AMERICAN RADIO RELAY LEAGUE, INC
January 16-17, 1987

AGENDA

1) Roll Call
2) Moment of Silence
3) Consideration of the agenda for the meeting
4) Approval of Minutes of 1986 Second Meeting
5) Supplementary oral reports by the Officers
6) Receive reports and consider recommendations of the committees
7) Election of Executive Committee
8) Appointment of committees
9) Election of Foundation Directors
10) Directors' motions
11) Authorizations of certain expenses for 1987

1) Pursuant to due notice, the Board of Directors of the American Radio Relay League, Inc., met in annual session at the Parkview-Hilton Hotel in Hartford, Connecticut, on January 16, 1987. The meeting was called to order at 8:30 AM EST, with President Larry E. Price, W4RA, in the Chair and the following directors present: Thomas B. J. Atkins, VE3CDM, Canadian Division; Frank M. Butler, Jr., W4RH, Southeastern Division; Rush S. Drake, W7RM, Northwestern Division; Thomas W. Frenaye, K1KI, New England Division; Paul Grauer, WØFIR, Midwest Division; Jim Haynie, WB5JBP, West Gulf Division; Fried Heyn, WA6WZO, Southwestern Division; Clyde O. Hurlbert, W5CH, Delta Division; Howard Mark, WØOZC, Dakota Division; Stephen A. Mendelsohn, WA2DHF, Hudson Division; Edmond A. Metzger, W9PRN, Central Division; Gay E. Milius, Jr., W4UG, Roanoke Division; Marshall Quiat, AGØX, Rocky Mountain Division; Rodney J. Stafford, KB6ZV, Pacific Division; Hugh A. Turnbull, W3ABC, Atlantic Division; George S. Wilson, III, W4OYI, Great Lakes Division.

Also in attendance as members of the Board without vote were Jay A. Holladay, W6EJJ, First Vice President; Leonard M. Nathanson, W8RC, Vice President; William J. Stevens, W6ZM, Vice President; Tod Olson, KØTO, International Affairs Vice President; and David Sumner, K1ZZ, Executive Vice President. Also in attendance at the invitation of the Board as observers were the following Vice Directors: Thomas W. Comstock, N5TC, West Gulf Division; Evelyn D. Gauzens, W4WYR, Southeastern Division; John C. Kanode, N4MM, Roanoke Division; James Knochenhauer, K6ITL, Pacific Division; James M. Mozley, W2BCH, Atlantic Division; Lionel A. Oubre, K5DPG, Delta Division; Wayne Overbeck, N6NB, Southwestern Division; Richard Ridenour, KBØZL, Midwest Division; Allan L. Severson, AB8P, Great Lakes Division; William R. Shrader, W7QMU, Northwestern Division; Paul Vydareny, WB2VUK, Hudson Division; Robert Weinstock, KN1K, New England Division; Richard Whiting, WØTN, Dakota Division; and Hugh Winter, W5HD, Rocky Mountain Division. There were also present Harry J. Dannals, W2HD, President Emeritus; Honorary Vice President Robert York Chapman, W1QV; Secretary Perry Williams, W1UED; Past Director Lys J. Carey, KØPGM; Counsel Christopher D. Imlay, N3AKD; Canadian Counsel B. Robert Benson, Q.C., VE2VW; John F. Lindholm, W1XX, Membership Communications Services Manager; Stephen C. Place, WB1EYI, Volunteer Resources Manager; John H. Nelson, W1GNC, Deputy Publications Manager; and Karl H. Muller, W3UBQ, Senior Staff Advisor for Planning and Operations.

2) The assembly observed a moment of silence in recollection of those who have passed away since the previous Meeting of the Board, especially ARRL Controller Michael Zeigler.

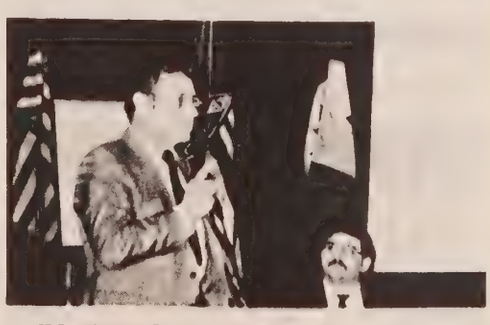
3) The Chair introduced new Directors Stephen A. Mendelsohn, WA2DHF, Hudson Division; Rush S. Drake, W7RM, Northwestern Division; Marshall Quiat, AGØX, Rocky Mountain Division; and Jim Haynie, WB5JBP, West Gulf Division. Mr. Mendelsohn introduced Vice Director Paul Vydareny, WB2VUK, Hudson Division; Mr. Frenaye introduced Vice Director Robert Weinstock, KN1K, New England Division; Mr. Drake introduced Vice Director William R. Shrader, W7QMU, Northwestern Division, and Mr. Quiat introduced Vice Director Hugh Winter, W5HD, Rocky Mountain Division.

Roanoke Director W4UG discusses a point with Rocky Mountain Director AGØX.

4) On motion of Mr. Milius, seconded by Mr. Mendelsohn, the agenda was adopted as presented.

5) On motion of Mr. Wilson, seconded by Mr. Butler, it was VOTED that the Minutes of the 1986 Second Meeting are approved in the form in which they appeared in the September 1986 issue of *QST*.

6) Moving now to agenda item 5, reports of the Officers were presented. In his written report, Mr. Price mentioned his efforts to make contact and exchange views with ARRL members, importantly through attendance at ARRL sponsored conventions—ten of them in 1986. Mr. Price met with three of the four standing committees during 1986, and plans to do so from time to time in the interest of improved communications and coordination of effort. International travel included the President's visit to the Deutscher Amateur Radio Club convention in Friedrichshafen, Federal Republic of Germany and to the headquarters of the International Telecommunication Union in Geneva in July, and to the International Amateur Radio Union Region 2 Triennial Conference in Buenos Aires in October. Mr. Price also reported on the meeting of the Ad Hoc Committee on the Strengthening of the Canadian Radio Relay League (CRRL); the Annual Meeting of CRRL; and a meeting of the ARRL Legal Strategy Committee. The number of ARRL members and the number of amateur radio licensees both were higher in 1986, though neither was as high as we had hoped. The President is responsible, under By-Law 31, for liaison with the Government, with the assistance of staff and counsel; accordingly, a report of his December Washington contact trip was included. In extensive oral remarks, the President reported on the League's successful efforts to modify the Electronic Communications Privacy Act of 1986 so the Act would not adversely affect amateurs. The President requested that an article be prepared for *QST* to inform the members on this activity. Mr. Price also traced the course of PR Docket 85-196, through which the Federal Communications Commission intends to turn over maintenance of the examination question pools to the Volunteer Examiner Coordinators. The League is awaiting Commission action on its petitions for a stay of the effective date and for reconsideration. Finally, Mr. Price discussed litigation arising from an amateur enforcement matter.



N5TC, West Gulf Vice Director, as Chairman and Board Liaison, presents the far-reaching report of the Blue Ribbon Committee on Emergency Message Traffic.

7) The Board was in recess from 10:20 to 10:50 PM.

8) First Vice President Holladay presented his written report, and touched on its highlights orally. Recruiting efforts showed a small but encouraging growth in the Amateur Radio Service during 1986. The most important challenge is to continue recruiting of amateurs from all age groups, and improve retention of these amateurs. Attention must also be given to the recruiting and training of Amateur Radio volunteers, building on gains already registered by the Volunteer Resources Committee of the Board and the Volunteer Resources Group at HQ. Mr. Holladay also reported on efforts to establish a small museum and amateur radio station in memory of Don Wallace, W6AM, on part of his former property in Rancho Palos Verdes, California. Mr. Holladay's work on the Executive Committee and Special Study Committee on Advisory Committees was also mentioned, along with a brief report on celebrations marking the 60th anniversary of the Japan Amateur Radio League and the 25th anniversary of the OSCAR satellite series.

9) Vice President Nathanson's written report covered his service on the Administration and Finance Committee and as chairman of the Legal Strategy Committee, two very active parts of the League structure. Attendance at amateur banquets as speaker has provided the Vice President with insights on the grass-roots support for Amateur Radio and the League, satisfyingly evident from the number and quality of unpaid volunteers in the Amateur Service. Volunteer monitoring, volunteer examining, advisory committees and club recruitment all seem healthy. Challenges in the area of private issuance of secondary call signs and of the preservation of Amateur Radio's past remain ahead.

10) Vice President Stevens' written report focussed on transition to that office after eight active years as Pacific director. His work with the Volunteer Resources Committee and as chairman of the Committee of Tellers, which oversees ballot counting in ARRL Director and Vice Director elections, was related, along with a report on the 25th anniversary of the OSCAR program. During a holiday in the Orient, Mr. Stevens made presentations on Amateur Radio at Kiwanis meetings in Singapore and Hong Kong. The Vice President also called attention to the desirability of a planned recruiting program among retirees and Senior Citizens. A separate report was filed concerning the Committee of Tellers.

11) Next was the report of Mr. Olson as Vice President for International Affairs. Virtually all of the objectives of the League for the year in the international arena were achieved in 1986. The Region 2 Triennial Conference in Buenos Aires affirmed a member society's right to sole representation before its own administration; revised the Region 2 dues structure; selected the ARRL as host for the 1989 Triennial Conference; adopted the AX.25 protocol as the preferred interim standard for packet radio in the region and sought cooperation between the hemispheres in the promotion of packet; approved 160- and 10-meter band plans consistent with ARRL positions; and elected ARRL Director Butler to the Region 2 Executive Committee. The regional meeting also adopted HF band plans, alloting space for RTTY/AMTOR/Packet. "Reverse ID" for reciprocal stations (eg, HK3/W1UED instead of W1UED/HK3);

At the center table (l-r): Directors W5CH, W4OYI, WA2DHF, WØFIR, K1KI, W7RM (slightly obscured) and KB6ZV.

YYMMDD (that is, year-month-day) order for QSL card dates; and a World QRP day were also endorsed.

12) The Executive Vice President, Mr. Sumner, presented an extensive written report covering preparations for the arrival of the Novice Enhancement program: creation of a media plan to spread the word to the general public; drafting of a Novice (Element 2) syllabus encompassing the expected new privileges; improvement in Morse-code training material for *Tune in the World*; the Archie comic book and associated Archie Radio Club; an updated promotional video program, *The New World of Amateur Radio*, under the direction of Roy Neal, K6DUE; better initial information for prospective amateurs; improved course material for instructors; and improvements in relations with clubs. The sum of $231,000 has been budgeted by ARRL alone for amateur radio recruiting activities in 1987; the effort is also being supported by other funding provided by some companies active in the Amateur Radio industry. Other subjects covered at length were ARRL publications, membership promotion, personnel, finances, the near-completion of Project Goodwill, the International Travel Host Exchange, observance of the Bicentennial of the US Constitution, the proposed visitors' center, and a survey report requested by the Board in July. During the course of the above, Mr. Holladay took the Chair for Mr. Price from 11:28 to 11:44 AM.

13) An apology for absence of the Treasurer because of the press of his business affairs was offered on behalf of Mr. McCobb.

14) The extensive report of Counsel Imlay covered automatic transmitter identification systems (ATIS) as proposed by the FCC in General Docket 86-337; maintenance of question pools, FCC Docket 85-196; the ARRL petition to enhance Novice privileges, PR Docket 86-161; cable television terminal devices, General Docket 85-301; the FCC's "reduced power hours" policy in RFI cases; additional 40-meter privileges proposed for only those Novices operating in Hawaii, Alaska, Pacific and Caribbean Island areas, PR Docket 86-397; the ARRL request for implementation of the 18.068-18.168 MHz band; revision of the spread spectrum rules; and the biological effects proposals of the Environmental Protection Agency. The report also covered local antenna and interference matters.

15) At this point, the Board was in recess from 12:23 to 1:39 PM for luncheon, reassembling with all persons hereinbefore mentioned present, except Mr. Muller, on assignment for Board business.

16) Canadian Counsel Benson presented a short report concerning Tariff Board matters potentially affecting the importation of amateur gear into Canada; meetings with the Department of Communications and the Radio-Amateur du Quebec, Incorporated concerning license restructuring in Canada; various local antenna cases; and the drafting of proposed amendments to the ARRL Articles of Association and By-Laws to reflect the eventual complete autonomy of the Canadian Radio Relay League.

17) Mr. Grauer, as president, presented the report of the ARRL Foundation. The Barry Goldwater Scholarship Fund reached $61,000 and continues to grow. Other scholarship activity was also covered in the report. Funds of the Foundation reached $205,661, and there were no administrative expenses charged to its holdings in 1986.

18) Turning now to Agenda Item 6, Mr. Metzger, as chairman, presented the report of the Administration and Finance Committee. On his motion, seconded by Mr. Nathanson, the 1987 ARRL Budget was adopted as presented.

19) Past Director Carey presented the brief report of the Membership Services Committee concerning the Golden Jubilee of the DX Century Club, two alternate approaches to a telephone bulletin service, insurance matters, and a study of certificates for 25 and 40 years of membership in the League in addition to the pins presently available.

20) Mr. Frenaye, as alternate chairman, presented the report of the Publications Committee. It reported cancellation of the proposed newsstand publication; articles prepared for it will be placed elsewhere. The committee advised against making a reprint of the first year of *QST* as a 75th anniversary commemorative, but recommended that a 75-year history of Amateur Radio be commissioned instead. The new policy of payment for *QST* material has increased the flow of technical articles but, as yet, not the input of general-interest stories.

21) The report of the Volunteer Resources Committee was presented by Mr. Stafford, as alternate chairman. Three matters referred to the committee at the July meeting were reported on: review of criteria for Special Service Clubs, with a final report to be ready at the Second meeting; ARRL QSL cards; and expansion of the ARRL call-sign badge program to include QSL Bureau Managers and workers, Technical Advisors, Volunteer Examiners, Volunteer Counsel, and AIRS volunteers. A questionnaire is being developed to determine ways of increasing activity in radio clubs that would be of interest to members under 18 and to amateurs licensed less than a year. The Committee recommended against changing Public Service Honor Roll criteria at this time, since no clear consensus emerged from the study of that subject.

22) Mr. Price, as chairman, reported for the Executive Committee. A study of Article 9 regarding amendments to the Articles and Bylaws, requested at the July meeting has not yet pointed in a clear direction for change and will be continued.

23) Mr. Atkins, as chairman, reported for the Ad Hoc Committee on Strengthening the CRRL. No meeting was held during the second half of the year. Language to amend the ARRL Articles of Association and By-laws to reflect further steps in the autonomy of the CRRL will be presented by the committee at the July meeting.

24) Mr. Butler, as liaison, presented the report of the Ad Hoc Committee on Spread Spectrum. Articles have been generated for *QEX* on behalf of the Committee. One technical development has been on hold awaiting an interpretation of an FCC rule, but a solution of sorts seems to be in sight.

25) The final report of the Blue Ribbon Committee on Emergency Message Traffic was presented by Mr. Comstock, as chairman. Packet radio and similar digital techniques are the fastest growing part of Amateur Radio; it is possible now to handle a national emergency using these modes, and messages are routinely being exchanged by elements of the National Traffic System (NTS). A test of an HF packet network will be proposed to the FCC soon, with a group of stations requesting special temporary authorization for up to 1200 baud service under automatic control. A new national public service and emergency steering committee should be established with representation from ECAC, the NTS, AMSAT, the Board and served agencies such as the Federal Emergency Management Agency. During the course of the above, Mr. Muller returned to the meeting at 2:29 PM.

26) Mr. Holladay, as chairman, presented the extensive report of the Special Study Committee on Advisory Committees. In brief summary, the Committee found that there were two types of advisory committees, one on which expertise in the subject is paramount (eg, biological effects of rf energy) and one in which operator interest is ascendent, thus calling for a large, broadly based committee chosen on a divisional basis. Such committees include the DX and Contest Advisory Committees. The study group concluded, however, that it might be desirable for a working group of each advisory committee, consisting of five members chosen on a regional basis, to be funded for an in-person meeting each year. The Public Relations Advisory Committee, on the other hand, should be reconstituted as an expert body; it need not have a member from each division. ECAC should be expanded to cover all public-service communications and should be renamed appropriately as the Public Service Advisory Committee. The VHF/UHF and VHF Repeater Advisory Committees would be expanded in scope and revitalized. The report also covered relationships between the various bodies, ways to improve performance, and additional permanent or short term committees which might be helpful. The report was received with applause.

27) The Board was in recess from 3:06 to 3:31 PM, at which time the agenda was suspended so that Mr. Mark could inform the Board about an article appearing on page 12 of *LinkUp*, January 1987, mentioning amateur packet work of Dr. Gary Garriott, WA9FMQ, Pat Snyder, WAØTTW and Vice Director Whiting (applause).

28) Mr. Turnbull, as chairman, presented the report of the RFI Task Group, the major activity of which was taking part in the work of the Ad Hoc Committee on Public Law 97-259 of ANSI's Committee C-63. The ARRL petition for mandatory labelling of consumer devices to indicate whether or not measures to improve immunity to rf energy had been incorporated was twice denied by the FCC. However, there is interest in other forms of consumer education, which will be explored. An ARRL petition for forfeiture against Pacific Gas and Electric Company for long term interference to two amateur stations was also denied by the Commission. The RFI Task Group recommended that the working relationship with the National Cable Television Association be continued, even though activity was low in 1987.

29) The report of the Committee on Biological Effects of RF Energy was presented as prepared by its chairman, Past Director Ray Wangler. Its main business during the year was studying the proposals of the Environmental Protection Agency in its Docket A-81-43 concerning a national standard for exposure levels to rf energy.

30) Mr. Olson, as Liaison, presented the report of the Committee on Amateur Radio Digital Communication. The report covered international developments in packet radio; VHF development in the US, including a trend toward higher speeds; HF packet network development through special temporary authorizations for automatic stations; and protocol development. On motion of Mr. Olson, seconded by Mr. Stafford, the following resolution was unanimously ADOPTED:

WHEREAS, the following amateurs have diligently and significantly contributed to the development of Packet Radio through their participation as members of the ARRL Committee on Amateur Radio Digital Communication,

The Board of Directors of the ARRL now therefore does recognize and thank: Paul Rinaldo, W4RI, Doug Lockhart, VE7APU, Wally Linstruth, WA6JPR, Hank Magnuski, KA6M, Harold Price, NK6K, Terry Fox, WB4JFI, Phil Karn, KA9Q, Eric Scace, K3NA, Lyle Johnson, WA7GXD, and Marshall Quiat, AGØX, for their many years of service on the Digital Committee. Well done! (Applause.)

31) On motion of Mr. Heyn, seconded by Mr. Milius, it was unanimously VOTED that the Sixth ARRL Amateur Radio Computer Networking Con-

ference be held on August 29, 1987, in the Los Angeles area.

32) Mr. Nathanson, as chairman, presented the report of the Legal Strategy Committee covering such subjects as: tower fall ratios of freestanding and guyed towers; a draft model amicus brief; distribution of materials to Volunteer Counsels; the Electronic Communications Privacy Act; the right of amateurs to monitor radio frequencies; eligibility requirements for candidates for League office; restrictive covenants; individual legal problems; the maintenance of question pools in the volunteer examining program; and the dismissal of the League's RFI labelling petition.

33) Mr. Oubre, as liaison, reported briefly for the VHF Repeater Advisory Committee; it had no assignments and thus made no recommendations.

34) Mr. Kanode, as liaison, presented the report of the Contest Advisory Committee. It included a study of the club competition system which should be retained but fine-tuned; minor adjustments to DX contest rules and Sweepstakes; and prohibitions on nonradio means for alerting in the HF contests only.

35) Mr. Drake, as liaison, presented the report of the DX Advisory Committee covering incomplete work in progress.

36) The extensive report of the Emergency Communications Advisory Committee was presented as prepared by outgoing Chairman Joel Kandel, K1ΔT. Among other topics, the report discussed local memoranda of understanding; insurance for volunteers; packet-radio developments; videotape training materials; choice of frequencies for emergencies; future geostationary satellites; EC report forms; and packet radio traffic formatting.

37) Mrs. Gauzens, as liaison, presented the report of the Public Relations Advisory Committee. Its topics included the Archie comic book; progress toward a slide show for served agencies; preparations for a public information guidebook; and the updated video feature, *The New World of Amateur Radio*.

38) Mr. Overbeck, as liaison, reported briefly for the VHF/UHF Advisory Committee, recommending that the Board adopt 10.368 GHz as the narrowband calling frequency in the 3-cm amateur band.

W5HD is surprised to catch N4MM without his camera! For several years N4MM has been one of the unsung heroes of ARRL Board meetings: The photographs that accompany this and several previous Board articles are largely his handiwork. Tnx John!

39) Mr. Mendelsohn asked unanimous consent that the agenda be suspended, for the purpose of a motion related to the Advisory Committees. There being no objection, on his motion, seconded by Mr. Butler, it was unanimously VOTED that paragraph four of the Rules and Regulations Concerning Advisory Committees is suspended, pending final acceptance of the report of the Special Study Committee on Advisory Committees. Suspension of the paragraph will permit reappointment of chairmen of Advisory Committees who have completed two terms.

40) Moving now to Agenda Item 7, the Chair appointed Mr. Severson head teller and Messrs. Overbeck and Comstock as tellers for the election of four directors to the Executive Committee. Nominations being declared open, Mr. Atkins nominated Mr. Turnbull. Mr. Metzger nominated Mr. Grauer. Mr. Mark nominated Mr. Hurlbert. Mr. Mendelsohn nominated Mr. Butler. Mr. Grauer nominated Mr. Wilson. Mr. Heyn nominated Mr. Frenaye. On motion of Mr. Metzger, seconded by Mr. Mendelsohn, it was VOTED that nominations are closed. Nine votes being needed for election, at the end of the first ballot, the tellers declared Messrs. Grauer, Hurlbert and Wilson elected as members of the Executive Committee (Applause). On completion of the second ballot, Mr. Butler was declared elected (Applause).

41) Without objection, the naming of standing committee members was deferred until the first order of business on the morrow.

42) Mr. Metzger, as chairman, presented the report of the official availability committee for the ARRL Foundation. On motion of Mr. Quiat, seconded by Mr. Milius, the following slate of Directors of the ARRL Foundation was unanimously ELECTED, for the term shown: Mr. Mark, two years; Mr. Grauer, three years; Mr. Drake, three years; and Mr. Ralph V. Anderson, KØNL, three years.

43) The Board was in recess for dinner from 4:55 to 8:15 PM, reconvening with all persons hereinbefore mentioned present. Also present was Phillip M. Sager, WB4FDT, Regulatory Information Branch Manager.

44) On motion of Mr. Wilson, seconded by Mr. Mendelsohn, it was unanimously VOTED that 10,368 MHz be promoted as a narrowband Calling Frequency in accordance with the VUAC recommendation.

45) On motion of Mr. Mendelsohn, seconded by Mr. Butler, it was VOTED that the names of Past Presidents of the American Radio Relay League be printed in *QST* once each year. In addition to the names, the years of their respective terms shall be indicated.

46) On motion of Mr. Drake, seconded by Mr. Quiat, it was VOTED that the date for the 1988 National Convention is approved as September 9-11 at the Red Lion Inn, Jantzen Beach, Portland, Oregon.

47) On motion of Mr. Stafford, seconded by Mr. Hurlbert, the following resolution was ADOPTED:

WHEREAS, the ARRL Board of Directors at its July 1986 meeting reviewed the application of the Vegas Valley ARC to sponsor the 1989 ARRL National Convention and found the applicant to be qualifed and eligible under the guidelines established by the Board at its January 1986 meeting; and

WHEREAS, the Board selected Las Vegas as the site for the 1989 Convention; and

WHEREAS, the organizers of the event have, since the July 1986 Board meeting, encountered unforeseen difficulties in proceeding with plans for the 1989 convention; and

WHEREAS the organizers very much regret that because of these unforeseen difficulties they must withdraw their sponsorship of the 1989 convention,

THEREFORE, BE IT RESOLVED that:

a) The application of the Vegas Valley ARC is withdrawn.

b) The Executive Vice President is directed to publicize the fact that the ARRL Board of Directors is seeking applications to sponsor the 1989 National Convention under the guidelines determined by the Board of Directors at its 1986 Annual Meeting.

c) Applications to sponsor the 1989 National Convention shall be accepted until June 1, 1987 and a site shall be selected by the Board no later than the July 1987 Board meeting.

48) On motion of Mr. Butler, seconded by Mr. Frenaye, it was VOTED that the Board of Directors accepts the report of the Blue Ribbon Committee and directs the Executive Vice President to implement the recommendations of the report. The committee is hereby discharged. The Board of Directors is most appreciative of the hard work and dedicated efforts of each committee member.

49) On motion of Mr. Butler, seconded by Mr. Wilson, it was unanimously VOTED that the Board of Directors approves in principle the establishment of a permanent national public-service steering committee to be called the Amateur Radio Public Service Committee (APSCOM). The Volunteer Resources Committee will determine the composition and proposed funding for APSCOM and report its findings to the Board at its July 1987 meeting.

50) On motion of Mr. Grauer, seconded by Mr. Mendelsohn, it was VOTED that the Membership Services Committee study the offering of surety insurance for club officers, the amount of such coverage not to exceed $10,000.

WA2DHF and K5DPG pause for the camera during a coffee break.

51) On motion of Mr. Quiat, seconded by Mr. Butler, it was VOTED that the Board recess for the night at 8:57 PM. The Board reconvened the following day at 8:45 AM, with all persons hereinbefore mentioned being present except for Mr. Benson, who had departed from the meeting and Mr. Hurlbert; Mr. Oubre took the seat for the latter.

52) Returning to agenda item 8, Appointment of Committees, Mr. Price announced appointments to the Standing Committees of the Board as follows:

Administration and Finance—Mr. Metzger, Chairman; Mr. Turnbull, Alternate Chairman; Mr. Atkins; Vice President Nathanson; Vice Director Severson, Secretary.

Membership Services—Mr. Quiat, Chairman; Mr. Drake, Alternate Chairman; Mr. Milius; Vice President Holladay.

Publications—Mr. Olson, Chairman; Mr. Mark, Alternate Chairman; Mr. Haynie; Mr. Heyn.

Volunteer Resources—Mr. Stafford, Chairman; Mr. Mendelsohn, Alternate Chairman; Mr. Frenaye, Secretary; Vice President Stevens.

53) Mr. Price then announced the following appointments of Chairmen and Board Liaisons of other committees:

Digital Communications—Mr. Rinaldo, Chairman; Vice Director Comstock, Board Liaison.

Biological Effects of RF Energy—Vice Director Mozley, Chairman.

Strengthening of CRRL—Director Atkins, Chairman.

Spread Spectrum—Mr. David Borden, K8MMO, Chairman; Director Butler, Board Liaison.

Special Study Committee on Advisory Committees—Vice President Holladay, Chairman.

Legal Strategy Committee—Vice President Nathanson, Chairman; Director Stafford, Alternate Chairman.

RFI Task Group—Director Turnbull, Chairman.

DX Advisory Committee—Mr. John Parrott, W4FRU, Chairman; Director Drake, Board Liaison.

Contest Advisory Committee—Mr. Douglas Grant, K1DG, Chairman; Vice Director Kanode, Board Liaison.

Public Relations Advisory Committee—Mr. Richard Moseson, N2BFG, Chairman; Vice Director Gauzens, Board Liaison.

VHF Repeater Advisory Committee—Mr. Karl V. Pagel, N6BVU, Chairman; Vice Director Oubre, Board Liaison.

VHF/UHF Advisory Committee—Mr. H. Paul Shuch, N6TX, Chairman; Vice Director Overbeck, Board Liaison.

Emergency Communications Advisory Committee—Mr. Robert A. Josuweit, WA3PZO, Chairman; Vice Director Vydareny, Board Liaison.

54) Continuing then with agenda item 10, Directors' motions, on motion of Mr. Metzger, seconded by Mr. Grauer, it was VOTED that the ARRL Travel Policy (Administration and Finance Committee 15 January 1987 draft) supersedes the present Directors' Workbook ARRL Travel Policy.

55) On motion of Mr. Wilson, seconded by Mr. Mendelsohn, it was VOTED that the Public Relations Advisory Committee study and make any

appropriate recommendations concerning possible preparation of a TV series designed to arouse the interest of a viewer in becoming a ham and helping him to become one.

56) On motion of Mr. Mendelsohn, seconded by Mr. Atkins, it was unanimously VOTED that an Ad Hoc Committee of no more than four people be formed for the purpose of drafting a suggested set of ethical guidelines for use during amateur radio/media contact. Such committee shall consist of one member of the Board of Directors of the League, one member of the Public Relations Advisory Committee, and two members of the press. Guideline input should be sought from the press and other interested parties as well as from the Public Relations Advisory Committee. Such input shall be accomplished through solicitation in *QST*. The Committee shall report a draft set of guidelines to the Board at the Annual Meeting of 1988, and a final set of recommended guidelines at the 1988 Second Meeting of the Board. The guidelines, once adopted, shall be promulgated to the organization by notice in *QST*, the *Field Forum* and ARRL Press Kit.

57) On motion of Mr. Drake, seconded by Mr. Milius, it was VOTED that the DX Advisory Committee be funded for up to $3000 for an in-person conference of the three subcommittee chairmen and the chairman in mid to late 1987 to finalize a draft of proposed recommendations to the Board on the future of DXCC. During the course of the above, Mr. Hurlbert joined the meeting at 9:24 AM and resumed his seat.

58) On motion of Mr. Quiat, seconded by Mr. Frenaye, it was VOTED that the Volunteer Resources Committee study and prepare criteria for selection of sites and sponsors for League sponsored and approved conventions and hamfests.

59) It was moved by Mr. Butler, seconded by Mr. Heyn, that the ad-hoc Digital Committee meet with NTS Staff to explore modification of existing NTS message formats for digital networks. After discussion, it was moved by Mr. Wilson, seconded by Mr. Mendelsohn to amend the motion by striking the text and substituting therefor: "Reports from the Digital Committee, the Emergency Communications Advisory Committee and the Blue Ribbon Committee have all suggested that a steering committee be charged with developing, among other things, a traffic handling plan to lead us into the 21st century. The Digital Committee is charged with synthesizing these recommendations." After further discussion, on motion of Mr. Haynie, seconded by Mr. Mark, it was voted to POSTPONE consideration until after the lunch recess.

60) The Board was in recess from 9:36 AM to 10:23 AM.

61) On motion of Mr. Metzger, seconded by Mr. Grauer, the following resolution was ADOPTED:

WHEREAS:

a. At its July 1986 meeting the ARRL Board of Directors approved in principle the refurbishing of the Maxim Memorial Station, W1AW, and construction of an associated Visitors' Center at the Newington Headquarters, and instructed the officers and staff to proceed with the next phase of planning; and

b. One aspect of this planning was a survey of possible funding sources, the results of which suggest that there is sufficient financial support by ARRL members and nonmember amateurs to fund the construction project; and

c. The reasons for proceeding with this important project are as persuasive now as they were in July; and

d. The purposes of the project must now be effectively communicated to the Amateur Radio Community; and

e. There appear to be no major impediments to proceeding to the next stage of plan development; therefore,

BE IT RESOLVED by the ARRL Board of Directors, in annual meeting assembled,

a. that the officers and staff are authorized to develop and implement, in close consultation with the Administration and Finance Committee, a plan for the raising of funds for construction, maintenance and related improvements to the property;

b. that the plan shall include a vigorous program to explain to members and other potential contributors the special significance of this project to future generations of radio amateurs;

c. that the plan shall also include the creation of a "Committee for the Museum" made up of individuals qualified to render advice to ensure that the focus of this aspect of the project is on the *future;*

d. that no further funds shall be expended on architectural or engineering development until 10% of a fundraising goal shall have been achieved, and then only those necessary expenses preparatory to the solicitation of proposals for bid and only upon the recommendation of the Administration and Finance Committee and approval of the Executive Committee;

e. that progress shall be reviewed by the full Board prior to initiation of the bidding process; and

f. that the Executive Vice President is instructed to provide monthly progress reports to the Board via Directors' Letters, and to the membership via *QST*.

Messrs. Stafford and Milius requested to be recorded as voting against the resolution.

KN1K and W7QMU observe the proceedings as Vice Directors from the outer table.

62) On motion of Mr. Mark, seconded by Mr. Haynie, it was VOTED that the Executive Vice President make available to the membership a staff organization chart depicting the major HQ departments. Each department's major functions should appear below the department's identification box. This aid is to be made available free of charge upon request.

63) It was moved by Mr. Mendelsohn, seconded by Mr. Heyn, that the Executive Vice President is requested to study the cost effectiveness of a national incoming WATS line, with use to be limited to prospective hams for initial contact as part of the recruiting effort that will take place in conjunction with Novice Enhancement, and for members to order publications. After discussion, Mr. Mendelsohn WITHDREW the motion with the consent of his second.

64) At this time, Mr. Hurlbert rose on a point of privilege of the Assembly. On his motion, seconded by Mr. Mendelsohn, it was VOTED that the Board go into Executive Session at 11:15 AM. On motion of Mr. Nathanson, seconded by Mr. Stevens, it was VOTED that the Board arise from Executive Session at 11:29 AM.

65) On motion of Mr. Frenaye, seconded by Mr. Wilson, it was unanimously VOTED that the Board strongly supports plans in the new budget to provide a new service to members, the timely notification of license renewal deadlines, and further, requests that the Membership Services Committee monitor progress on implementation.

66) On motion of Mr. Stafford, seconded by Mr. Milius, it was VOTED that the Membership Services Committee study the feasibility of ARRL's producing a distinctive official QSL card for purchase by ARRL members. During the course of the above, at 11:33 AM, Mr. Holladay assumed the Chair for Mr. Price, Mr. Vydareny took the seat for Mr. Mendelsohn, Mr. Severson took the seat for Mr. Wilson, Mr. Oubre took the seat for Mr. Hurlbert, Mr. Winter took the seat for Mr. Quiat, and Messrs. Price, Mendelsohn, Wilson, Hurlbert, Quiat and Olson left the room.

67) On motion of Mr. Mark, seconded by Mr. Heyn, it was VOTED that the Board approves in principle the formation of advisory committee working groups as recommended by the Special Study Committee on Advisory Committees. The Special Study Committee, in conjunction with the Volunteer Resources Committee, is directed to prepare the necessary revisions to the Advisory Committee Rules and Regulations for review at the July Board meeting. During the course of the above, Mr. Sager departed at 11:38 AM and Mr. Comstock took the seat for Mr. Haynie at 11:42 AM.

68) It was moved by Mr. Stafford, seconded by Mr. Milius, that the Publications Committee of the Board of Directors of the American Radio Relay League study the feasibility and the advisability of including more coverage of the activities of ARRL affiliated clubs and Special Service Clubs in *QST*. The Publications Committee is to report its findings to the Board of Directors at the Second Meeting of 1987. ARRL staff is directed to prepare a brief guide outlining the requirements for publication of articles or items submitted by affiliated clubs to *QST*. Staff is directed to distribute the guide to all affiliated clubs along with a solicitation of reports and photos of club activities. After discussion, on motion of Mr. Vydareny, seconded by Mr. Metzger, it was voted to POSTPONE discussion until a later time. During the course of the above, those Board members who had previously left the room returned.

69) Mr. Price took the Chair at 12:02 PM and declared the Board to be in recess for lunch. The Board reconvened at 1:20 PM with all persons hereinbefore mentioned present with the exception of Mr. Chapman who had departed from the meeting.

70) On motion of Mr. Mark, seconded by Mr. Heyn, it was VOTED that in accordance with the recommendation of the Special Study Committee on Advisory Committees, and in order to provide improved support for the League's public-relations efforts, an ARRL Public Relations Committee shall be established, with members appointed by the President. This committee shall replace the present Public Relations Advisory Committee at the end of the 1987 term. The Board thanks and commends the members of the Public Relations Advisory Committee for their important contributions to Amateur Radio public relations activities. During the course of the above, Mrs. Gauzens took the seat for Mr. Butler at 1:28 PM.

71) On motion of Mr. Wilson, seconded by Mr. Mendelsohn, it was VOTED that the Board now consider the matter of message traffic via packet radio that was earlier postponed (Min. 59).

On motion of Mr. Wilson, seconded by Mr. Heyn, it was VOTED to amend the original motion by striking the text and substituting therefor the following: "Moved, that the Committee on Amateur Radio Digital Communication be charged to develop for Board ratification a proposal for facilitating NTS message handling (both regular and emergency), plus ancillary amateur-to-amateur message and data traffic via packet radio. The investigation should consider changes in message formats, system software or any other area which may be necessary to achieve the objectives. The Committee should incorporate the concepts developed by the Blue Ribbon Committee, Emergency Communications Advisory Committee, National Traffic System Area Staffs and providers/creators of existing software and hardware. The Committee is directed to report to the Board no later than the 1988 Annual Meeting."

The question then being on the motion as amended, it was ADOPTED. During the course of the above, Mr. Butler returned to his seat at 1:43 PM.

72) It was moved by Mr. Mendelsohn, seconded by Mr. Butler, that the Public Relations Advisory Committee study the feasibility of establishing a "hometown" news service at either the sectional or divisional level, to be reported back by the 1988 Annual Meeting. After extended discussion, Mr. Mendelsohn WITHDREW the motion with the consent of his second.

73) On motion of Mr. Mendelsohn, seconded by Mr. Heyn, it was VOTED that an Education Task Force is established. Its purposes shall be:

a) to review and update curricula for the teaching of all classes of amateur radio license using techniques currently available in the education discipline;

b) to explore and report innovative methods of establishing amateur radio clubs in elementary, and junior and senior high schools; and

c) to execute requests of the Board.

The Task Force shall consist of one Director or Vice Director as Liaison to the Board, a staff liaison member, and not more than six volunteer members selected from League membership. All members shall be appointed by the President. Initial funding for 1987 shall be $500.

74) On motion of Mr. Stafford, seconded by Mr.

Milius, it was VOTED that the Board resume consideration of the matter of club coverage in *QST* that had earlier been postponed (Min. 68).

Then, on motion of Mr. Milius, seconded by Mr. Heyn, it was VOTED to amend the original motion by striking the text and substituting therefor the following: "Moved, that the Publications Committee study the feasibility and the advisability of including more coverage of the activities of ARRL affiliated clubs and Special Service Clubs in *QST*. The Publications Committee is to report its findings to the Board of Directors at the Second Meeting of 1987."

The question then being on the motion as amended, it was ADOPTED.

75) On motion of Mr. Stafford, seconded by Mr. Frenaye, the following resolution was ADOPTED:

WHEREAS, the Special Study Committee on Advisory Committees has recommended that the role of the ARRL Awards Committee relative to the DX Advisory Committee and the Contest Advisory Committee be clarified, and that the standard operating procedures for the Awards Committee be reviewed, therefore,

IT IS AGREED, that

a) the Membership Services Committee is directed to study the role of the Awards Committee and its relationship to the DX Advisory Committee and the Contest Advisory Committee, and

b) the Membership Services Committee is directed to review the standard operating procedures for the ARRL Awards Committee with the objective of incorporating a mechanism whereby any inconsistency between the conclusions reached by the DX Advisory Committee or the Contest Advisory Committee and the Awards Committee is resolved.

76) It was moved by Mr. Stafford, seconded by Mr. Milius, that the Executive Vice President study the feasibility of acquiring, either by lease or purchase, a trailer/van to be outfitted with an amateur radio exhibit and an operating amateur radio station. Staff is to study the alternative methods of moving the trailer/van throughout the United States in order to maximize public exposure to such van including visits to fairs, schools, gatherings of public safety officials, conventions of nonamateur organizations, etc. After discussion, on motion of Mr. Metzger, seconded by Mr. Quiat, the motion was TABLED. Mr. Heyn requested to be recorded as voting opposed to the motion to table.

77) It was moved by Mr. Heyn, seconded by Mr. Stafford, that the Administration and Finance Committee is directed to study the feasibility of increasing the financial rebate to Special Service Clubs for new ARRL memberships and renewals. It was then moved by Mr. Frenaye, seconded by Mr. Butler, that the motion be amended by striking the words "Special Service Clubs" and substituting therefor the words "affiliated clubs." After discussion, the motion to amend was LOST; the question then being on the original motion, it too was LOST.

78) It was moved by Mr. Heyn, seconded by Mr. Milius, that the ARRL Call-Sign Badge Program for ARRL Field Organization appointees be expanded to include the following: QSL Bureau Managers and workers, Technical Advisors, Volunteer Examiners, Volunteer Counsel and AIRS volunteers. The eligibility standards and the procedures for obtaining badges for these additional volunteers shall be as set forth in the Volunteer Resources Committee report delivered at the January 1987 ARRL Board of Directors Meeting.

After discussion, it was moved by Mr. Grauer to amend the motion by striking the words "Volunteer Counsel," but the motion to amend was LOST for lack of a second. It was then moved by Mr. Butler, seconded by Mr. Wilson, to amend the procedures as set forth in the Volunteer Resources Committee report by stipulating that the certification of Volunteer Examiners for the badge program be accomplished at ARRL Headquarters. After discussion, the motion to amend was LOST. It was then moved by Mr. Hurlbert, seconded by Mr. Grauer, that the matter be referred back to the Volunteer Resources Committee for further study, but the motion to refer was LOST. The question then being on the original motion, it was ADOPTED.

79) The Board was in recess from 3:08 PM to 3:32 PM.

80) On motion of Mr. Haynie, seconded by Mr. Stafford, it was VOTED that the Membership Services Committee deliver its recommendations on the packet band plan as per Minutes 45a and 45h of the 1986 Annual Meeting no later than the July 1987 Board meeting.

Intent on the discussion are Directors W4OYI, WA2DHF, WØFIR, K1KI and W7RM.

81) On motion of Mr. Frenaye, seconded by Mr. Wilson, it was VOTED that the Executive Committee review the procedures used in evaluating the qualifications of candidates for Director and Vice Director to hold office under the Articles of Association and By-Laws.

82) Moving now to item no. 11(a) on the Agenda, Administrative Expenses for Directors for 1987, on motion of Mr. Stevens, seconded by Mr. Turnbull, it was VOTED that the Executive Vice President is hereby authorized to reimburse the Division Directors for actual expenses incurred by them during the year 1987 in the proper administration of ARRL affairs in their respective divisions, and in accordance with Board policy, up to the amounts as follows:

Atlantic Division	$11,500
Central Division	8,000
Dakota Division	4,500
Delta Division	10,000
Great Lakes Division	11,000
Hudson Division	8,500
Midwest Division	6,500
New England Division	9,500
Northwestern Division	13,000
Pacific Division	10,500
Roanoke Division	10,500
Rocky Mountain Division	7,000
Southeastern Division	11,000
Southwestern Division	11,900
West Gulf Division	9,500

83) On motion of Mr. Haynie, seconded by Mr. Mendelsohn, it was VOTED that the Executive Vice President is hereby authorized to reimburse the following Committees, Task Groups and Task Forces created by the Board, for expenses incurred by them during the year 1987 in the proper execution of their duties, and in accordance with Board policy, as follows:

Ad Hoc Committee on Strengthening of CRRL	$ 6,000
Ad Hoc Committee on Spread Spectrum	-0-
RFI Task Group	2,500
Committee on the Biological Effects of RF Energy	3,500
ARRL Committee on Amateur Radio Digital Communication	17,000
Legal Strategy Committee	15,000
Special Study Committee on Advisory Committees	3,000

84) On motion of Mr. Milius, seconded by Mr. Turnbull, it was VOTED that to continue the Board's policy of reimbursing QSL Bureau Managers of the League for certain travel in furthering ARRL organizational objectives, the Executive Vice President is hereby authorized to pay during the year 1987 a total amount not to exceed $4,000 under terms prescribed by the general pattern established by the Board.

85) On motion of Mr. Butler, seconded by Mr. Quiat, it was VOTED that, to continue the Board's policy of reimbursing National Traffic System officials above the section level for certain approved expenses in furthering ARRL organizational objectives, the Executive Vice President is hereby authorized to pay during the year 1987 a total amount not to exceed $12,000 under terms prescribed by the Field Services Manager following the general pattern established by the Board.

86) On motion of Mr. Heyn, seconded by Mr. Quiat, it was VOTED that, to continue the policy of the Board to assume the administrative expenses of the ARRL Foundation, the Executive Vice President is hereby authorized to pay during the year 1987 a total amount not to exceed $2,000 in accordance with ARRL standing policies with respect to travel, accounting procedures and auditing.

87) Moving now to item no. 11(f) on the Agenda, Supplemental Authorizations for 1986, on motion of Mr. Turnbull, seconded by Mr. Atkins, it was VOTED that the recommendation of the Administration and Finance Committee is approved and that the Executive Vice President is authorized to reimburse the Central Division by an amount not to exceed $709.98 and the Dakota Division by an amount not to exceed $100, for additional 1986 expenses.

88) On motion of Mr. Nathanson, seconded by Mr. Frenaye, the following resolution was unanimously ADOPTED:

WHEREAS, Mike Kaczynski, W1OD, and Becky Lindholm have toiled with diligence and in excess of the required devotion,

BE IT RESOLVED, that Mike Kaczynski, W1OD, and Becky Lindholm be commended for the excellent word processing of motions and cooperation with the Board during the Annual Meeting of January, 1987, and

BE IT FURTHER RESOLVED, that the Board wishes Mike every success in his future career (applause).

89) On motion of Mr. Drake, seconded by Mr. Frenaye, the matter of the trailer/van mobile exhibit was lifted from the table (Min. 76). On motion of Mr. Drake, seconded by Mr. Haynie, it was unanimously VOTED to amend the motion by striking the text and substituting therefor the following: "Moved, that the Executive Vice President is encouraged to explore with amateur radio industry representatives how the League and the industry representatives might cooperate in providing expanded opportunities for the general public to gain knowledge about Amateur Radio, including but not limited to, a mobile van display." The question then being on the motion as amended, such motion was ADOPTED.

90) On motion of Mr. Milius, seconded by Mr. Stafford, it was unanimously VOTED that the Board sincerely thanks the volunteers who work in the ARRL QSL Bureaus for their dedication and efforts (applause).

91) On motion of Mr. Olson, seconded by Mr. Butler, it was unanimously VOTED that the Secretary is directed to cast the ARRL vote on IARU proposal No. 183 (concerning the admission of Liechtenstein as a member of the IARU) in support of admission.

92) There followed an opportunity for all present to make final comments. There being no further business, on motion of Mr. Turnbull, seconded by Mr. Mark, the Board adjourned *sine die* at 4:28 PM. Total time in session as a Board: 11 hours, 56 minutes; direct authorization: $212,209.98.

Respectfully submitted,
Perry Williams, W1UED
Secretary

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D. C. 20554

General Docket No. 87-14

In the Matter of

Amendment of Part 2	
of the Commission's Rules	RM-4829
Regarding the Allocation of	RM-4831
the 216-225 MHz band.	RM-4983

NOTICE OF PROPOSED RULE MAKING

Adopted: February 2, 1987 Released: February 12, 1987

By the Commission:

INTRODUCTION

1. By this action the Commission proposes to: 1) maintain the existing 216-220 MHz band allocation; 2) allocate the 220-222 MHz band on a exclusive basis to the land mobile service for both government and nongovernment operations; and, 3) allocate the 222-225 MHz band on a exclusive basis to the amateur service. This proceeding addresses only the allocation of this spectrum. A subsequent proceeding will address the necessary service rules for the new allocations that may result from this proceeding.

BACKGROUND

Planning Activities

2. Prior to the 1979 World Administrative Radio Conference (1979 WARC), the 216-225 MHz band was allocated on a primary basis to the government radiolocation service. There were secondary allocations in the 216-220 MHz portion of the band for the aeronautical mobile, fixed and land mobile services for telemetry operations; and, there was a secondary allocation in the 220-225 MHz portion for the amateur service. During the preparation for the 1979 WARC, it was determined that the 216-225 MHz band was not sufficient to meet future United States radiolocation requirements. [1] Therefore, this band was considered a candidate for reallocation for other purposes. At about the same time, a requirement for maritime mobile public correspondence was identified that could be accommodated in this band. Accordingly, the United States proposed at the 1979 WARC that the entire 216-225 MHz band be reallocated internationally to the maritime mobile service. That proposal was not adopted in its entirety. However, the 1979 WARC did allocate the 216-220 MHz portion to the maritime mobile service along with the fixed service on a primary basis and allocated the 220-225 MHz portion to the mobile service along with the fixed and amateur services on a primary basis. The 1979 WARC also provided for phasing-out the radiolocation service. [2]

3. Shortly after the 1979 WARC the Commission allocated the 216-220 MHz band to the maritime mobile service on a primary basis for the inland waterways communication system. [3] Secondary allocations in the 216-220 MHz band were retained for the aeronautical mobile, fixed and land mobile services for telemetry operations. Subsequently, the Commission reallocated the 220-225 MHz band to the amateur, fixed and mobile services on a coequal primary basis for nongovernment services. [4] The National Telecommunication and Information Administration (NTIA), in implementing the 1979 WARC results into the government table of frequency allocations, allocated the 220-225 MHz band on a coequal primary basis to the fixed and mobile services. However, NTIA and the FCC agreed that operations in the fixed and mobile services in the 220-225 MHz band would not be initiated until an allocation plan was developed for sharing the band by government and nongovernment users. [5] Later, an FCC/NTIA planning group recommended that a portion of the 216-225 MHz band be designated for narrowband land mobile operations on a shared basis between government and nongovernment users. [6]

Petitions for Rulemaking

4. The Commission also has received three petitions for rule making addressing allocations in the 216-225 MHz band. These were submitted by Land Mobile Communications Council (LMCC), Sideband Technology, Inc. (STI) and LAOAD Radio and Microwave Communications Consultants (LAOAD). [7,8] The petitioners requested that a portion of the 216-225 band be allocated to the land mobile service for narrowband voice operations (5 kHz channels). The petitioners argued that an additional land mobile allocation is needed to help meet the private land mobile spectrum requirements through the year 2000. They stated that current narrowband equipment designed to operate in the 150 MHz land mobile band could be easily modified to operate in the 220 MHz band. Further, they asserted that since transmission characteristics at 220 MHz are similar to those in the 150 MHz band, the 220 MHz band would be attractive to users who otherwise would be seeking channels at 150 MHz. They argued that the 220 MHz band would be a good place to implement 5 kHz channel land mobile operations, due to the light loading of the band and because a channelization plan would not have to work around existing FM channels. [9] LAOAD further requested a primary allocation to the fixed service in the 216-220 MHz band for narrowband voice and telemetry operations (5 kHz and 2.5 kHz channels respectively). LAOAD argued that there is a growing need for telemetry channels, noting particularly oil, gas and utility companies that need to monitor and control many remote stations from a single location.

5. In response to the petitions, there was strong support from the land mobile community for an allocation for land mobile; however, there was only modest support for a fixed allocation. There was strong opposition from existing maritime mobile and telemetry users operating in the 216-220 MHz band and amateurs operating in the 220-225 MHz band. These existing users claimed that these bands are needed to meet their own respective spectrum requirements. Further, broadcast interests were concerned about potential interference to the reception of TV channel 13 operations in adjacent spectrum at 210-216 MHz.

DISCUSSION

6. Based on our analysis and the comments submitted in response to the petitions, we believe that the present allocations in the 216-220 MHz portion of the band are appropriate and should be maintained. Accordingly, we are not proposing any allocation changes to this portion of the spectrum. With regard to the 220-225 MHz portion of the band, we are persuaded that this band is presently underutilized and that the land mobile service has needs that can be met in this region of the spectrum.[10] The propagation characteristics of this band make it useful for land mobile operations. Further, a land mobile allocation in this region of the spectrum would provide an opportunity for the further development of narrowband technologies. Therefore, we are proposing a 2 megahertz allocation to the land mobile service in the 220-222 MHz portion of the band. [11] The remaining 3 megahertz, 222-225 MHz, is proposed to be made an exclusive allocation for the amateur service. These matters are discussed below.

UNDERUTILIZED

216-220 MHz Band

7. The 216-220 MHz band is currently allocated to the maritime mobile service on a primary basis. Telemetry operations in the aeronautical mobile, fixed and land mobile services are permitted on a secondary basis.[12] We are not proposing any changes to this allocation.

8. We believe it would be premature to permit additional services in the 216-220 MHz band before the inland waterways communication system in this band has had a chance to develop as planned. It is also our belief that the geographical limitations on land mobile operations at 216-220 MHz necessary to protect broadcast TV channel 13 operations would be so restrictive that an allocation in this portion of the spectrum would provide little relief for land mobile. This would be especially the case in the major cities where land mobile demand is greatest.[13] Further, there is no international land mobile allocation in this portion of the band, so domestic land mobile operations would be secondary to operations of other countries that are operating in accordance with the international Table of Frequency Allocations. This might greatly restrict domestic land mobile operations near the borders. For these reasons we do not believe it is in the public interest to propose a primary land mobile allocation below 220 MHz.

9. We believe that the needs of the fixed services can be satisfied within the present secondary allocation in the 216-220 MHz band. We reject LAOAD's request to upgrade the secondary fixed allocation to primary. At this time, we are reluctant to take any action that might restrain the development of the inland waterways communications system. LAOAD's request that narrowband voice operations be permitted in the fixed service may be more appropriately addressed in a separate proceeding dealing with service rules for this band.

220-225 MHz Band

10. The 220-225 MHz band, which is allocated to the amateur, fixed, mobile and radiolocation services, is currently utilized only by the amateur and radiolocation services as noted above. The amateur usage is mainly for base/mobile repeater operations, along with some special operations.[14] The Commission is cognizant of the services performed by the amateur community in this band and the other amateur bands. We are also aware of the investment by the amateur community in equipment in this band. However, the loading of this band is light in comparison with the 144-148 MHz amateur band, which supports similar operations. The 144-148 MHz band supports over six times as many repeater operations (repeaters/MHz) as the 220-225 MHz band.[15]

11. The majority of the amateur operations in the 220-225 MHz band are base/mobile repeater operations and are located in the 222-225 MHz portion of the band. Accordingly, we believe that reallocating 2 megahertz, 220-222 MHz, to the land mobile service, would have minimal impact on current amateur operators and would provide much-needed spectrum for land mobile operations. Further, in view of the current light loading of the 220-225 MHz band, and the availability of other amateur bands, it appears that the future needs of the amateur service will continue to be satisfied. We anticipate that this proposed action will have little economic impact on amateur operators since amateur equipment operating in the 220-222 MHz band could be modified at minimal expense to operate in the 222-225 MHz portion of the band.

12. With regard to a fixed service allocation in the 220-225 MHz band, we believe the needs of the land mobile and amateur services, as addressed above, outweigh those of the fixed service. Furthermore, fixed services can be accommodated in higher frequency bands, whereas land mobile use is best suited to frequencies below 1 GHz. Therefore, we are proposing to delete the unimplemented fixed allocation in the 220-225 MHz band. In the 222-225 MHz band, we are also proposing to delete the unimplemented mobile allocation. This will provide the amateur service with an exclusive allocation in the 222-225 MHz band after January 1, 1990.[16]

PROPOSAL

13. In summary, we are proposing to reallocate the 216-225 MHz band as follows: (1) maintain the primary maritime mobile allocation in the 216-220 MHz band; (2) maintain the secondary aeronautical mobile, fixed and land mobile allocations in the 216-220 MHz band for telemetry operations only; (3)reallocate the 220-222 MHz band on a primary basis to the land mobile service for both government and nongovernment operations and delete the existing primary allocations to the amateur, fixed and mobile services; and (4) maintain the primary amateur allocation in the 222-225 MHz band and delete the existing primary allocations to the fixed and mobile services. The primary allocation to the radiolocation service for government operations in the 216-225 MHz band would be maintained until 1990, when radiolocation would become secondary except for one Navy radar system. Specific operating rules for the land mobile service at 220-222 MHz would be developed in a further proceeding.

REGULATORY FLEXIBILITY ANALYSIS

14. Pursuant to the Regulatory Flexibility Act of 1980, the Commission finds as follows:

I.Reason for Action

This proposal would reallocate the 216-225 MHz band. It responds to an unresolved issue of General Docket 80-739, Implementation of the 1979 World Administrative Radio Conference, which left the allocation of this band

open until a separate proceeding could address all of the issues involved; it responds as well to three petitions for reallocation received by the Commission.

II. Objective:

. The Commission is advancing this proposal to resolve the allocation issues of the 216-225 MHz band.

III. Legal Basis:

The proposed action is authorized under Sections 4(i) and 303(r) of the Communications Act of 1934, as amended, which authorize the Commission to make such rules and regulations as may be necessary to improve the efficiency of spectrum use.

IV. Description, Potential Impact and Number of Small Entities Affected:

This proposal will help satisfy radio needs of private land mobile radio services as well as increase market opportunities for radio manufacturers, some of which may be small businesses. Beyond this we are unable to quantify the potential effects on small entities. We, therefore, invite specific comments on this point by interested parties.

V. Reporting, Recordkeeping and other Compliance Requirements:

No new requirement will be imposed upon the Commission's licensees.

VI. Federal Rules which Overlap, Duplicate or Conflict with this Rule:

None.

VII. Significant Alternatives

There are no significant alternatives which would accomplish our stated objective of allocating the 216-225 MHz band.

15. IT IS ORDERED that the Secretary shall serve a copy of this *Notice* on the Small Business Administration.

16. The proposals contained herein have been analyzed with respect to the Paperwork Reduction Act of 1980 and found not to propose a new or modified information collection requirement on the public. Implementation of any new or modified requirement will be subject to approval by the Office of Management and Budget as prescribed by the Act.

17. For purposes of this non-restricted notice and comment rule making, members of the public are advised that ex *parte* contacts are permitted from the time the Commission adopts a notice of proposed rule making until the time a public notice is issued stating that a substantive disposition of the matter is to be considered at a forthcoming meeting or until a final order disposing of the matter is adopted by the Commission, whichever is earlier. In general, an ex *parte* presentation is any written or oral communication (other than formal written comments/pleadings and formal oral arguments) between a person outside the Commission and a Commissioner or a member of the Commission's staff which addresses the merits of the proceeding. Any person who submits a written ex *parte* presentation must serve a copy of the presentation on the Commission's Secretary for inclusion in the public file. Any person who makes an oral ex *parte* presentation addressing matters not fully covered in any previously filed written comments for the proceeding must prepare a written summary of that presentation; on the day of oral presentation, that written summary must be served on the Commission's Secretary for inclusion in the public file, with a copy to the Commission official receiving the oral presentation. Each ex *parte* presentation described above must also state by docket number the proceeding to which it relates. See generally, Section 1.1231 of the Commission's Rules, 47 C.F.R. 1.1231.

18. This action is taken pursuant to Sections 4(i), and 303(r), of the Communications Act of 1934, as amended. Interested persons may file comments on this proposal on or before April 6, 1987, and reply comments on or before April 21, 1987. All relevant and timely comments filed in accordance with Sections 1.415 and 1.419 of our rules and regulations (47 C.F.R. 1.415 and 1.419) will be considered by the Commission before final action is taken in this proceeding. In reaching its decision, the Commission may take into consideration information and ideas not contained in the comments, provided that such information is placed in the public file, and provided that the Commission's reliance on such information is noted in its final decision.

19. In accordance with the provisions of Section 1.419 of the Rules and Regulations, 47 C.F.R. 1.419, formal participants shall file an original and five copies of their comments and other material. Participants wishing each Commissioner to have a personal copy of their comments should file an original and eleven copies. Members of the general public who wish may express their comments without regard to form (as long as the docket number is clearly stated in the heading). All documents will be available for public inspection during regular business hours in the Commission's Public Reference Room at its headquarters in Washington, D.C.

20. For further information concerning this rule making contact Mr. Fred Thomas at (202) 653-8112, Office of Engineering and Technology, Federal Communications Commission, Washington, D. C. 20554.

PROPOSED RULE CHANGES

Part 2 of Chapter I of Title 47 of the Code of Federal Regulations is proposed to be amended as follows:

The authority citations in Part 2 continues to read:

Authority: Secs. 4, 303, 48 Stat. 1066, 1082 as amended; 47 U.S.C. 154, 303. Part 2 - Frequency Allocations and Radio Treaty Matters; General Rules and Regulations.

Section 2.106 is amended by modifying the 216-225 MHz band as follows:

Sec. 2.106 Table of Frequency Allocations

UNITED STATES TABLE		FCC USE DESIGNATORS	
GOVERNMENT	NON-GOVERNMENT		
ALLOCATION MHz (4) ***	ALLOCATION MHz (5) ***	RULE PART(S) (6) ***	SPECIAL-USE FREQUENCIES (7) ***
216-220	216-220		
MARITIME MOBILE Aeronautical Mobile Fixed Radiolocation 627	MARITIME MOBILE Aeronautical Mobile Fixed Land Mobile 627	MARITIME (81 & 83) Private Land Mobile (90)	
US210, US229 US274, G2	US210, US229 US274, NG121		
220-222 LAND MOBILE Radiolocation 627 US243, G2	220-222 LAND MOBILE 627, US243	PRIVATE LAND MOBILE (90)	
222-225 Radiolocation 627 US243, G2	222-225 AMATEUR 627, US243	AMATEUR (97)	

FEDERAL COMMUNICATIONS COMMISSION

William J. Tricarico
Secretary

FOOTNOTES

[1] An exception was made for the Navy SPASUR radar system operating in the southern United States in the 216.88- 217.88 MHz band. This system tracks rocket and missile trajectories.

[2] The phase-out of radiolocation was handled by implementing the provisions of Footnotes 627 and US243 in the United States. Footnote 627 to the international Table of Frequency Allocations states that the band 216-225 MHz is allocated to the radiolocation service on a primary basis until 1 January 1990. On and after 1 January 1990 no new stations in that service may continue to operate on a secondary basis. Footnote US243 to the domestic Table of Frequency Allocations states that in the 220-225 MHz band stations in the radiolocation service have priority until 1 January 1990.

[3] *See Report and Order* in General Docket No. 80-1, 46 Fed. Reg. 15690 (March 9, 1981).

[4] *See Report and Order* in General Docket No. 80-379, 49 Fed. Reg. 2358 (January 19, 1984).

[5] *See id.*, at Paras. 30 and 31.

[6] Among the information considered by the FCC/NTIA planning group was the NTIA Report, *Spectrum Resource Assessment in the 216-225 MHz Band* (NTIA Report 81-85, September 1981).

[7] *See:* (1) *Petition for Rule Making* filed by Land Mobile Communications Council, RM-4829 (June 1984), requesting amendment of Parts 2, 22, and 90 of the rules and regulations to make available additional frequency assignments in the land mobile radio services; (2) *Petition for Rule Making*, filed by Sideband Technology, Inc., RM-4831 (July 1984), requesting reallocation of 6 MHz at 216-222 MHz to the private land mobile radio services for narrowband systems using 5 kHz channeling; and (3) *Petition for Rule Making* filed by LAOAD Radio and Microwave Communications Consultants, RM 4983 (March 1985), requesting a reallocation of 4 MHz at 216-220 MHz to the private land mobile radio services for narrowband voice and low speed data communications systems.

[8] The Commission has also recently received two additional petitions pertaining to the 216-225 MHz band. The Association of Radio Reading Services (ARRS) submitted a petition, RM-5434, requesting the Commission to allocate 500 kHz on a nationwide basis from the 220-225 MHz band to provide spectrum for radio reading services for the print handicapped. This petition has been denied in a companion Memorandum Opinion and Order adopted by the Commission on January 30, 1987, FCC 87-41. Another petition, filed by Cubic Communications, Inc. (Cubic), requests the Commission to allocate the 216.0125-219.9875 MHz band to the fixed service for voice and telemetry operations on narrowband channels. Because the Cubic request is essentially the same as that by LAOAD in its petition, we did not put the Cubic petition on public notice; however, the substance of Cubic's request is covered herein.

[9] The Commission has provided for narrowband operation in the 150-174 MHz private land mobile band. *See Report and Order* in PR Docket No. 84-279, FCC 85-96, 50 Fed. Reg. 13596 (April 5, 1985). In a letter dated November 10, 1986, which has been inserted in the record, STI contended that it has proven difficult to obtain widespread usage of narrowband equipment in the 150-174 MHz band due to existing heavy use by licensees using conventional equipment (i.e., 30 kHz channels) and technical constraints in the rules. We note, however, that other factors may be involved. For instance, narrowband equipment carries a price premium of about 25% over conventional equipment.

[10] For further information on land mobile's needs for additional spectrum, *See: Future Private Land Mobile Telecommunications Requirements:* Final Report, Planning Staff, Private Radio Bureau, FCC, Washington, D.C., August 1983; *Report and Order* in General Docket Nos. 84-1231, 84-1233, and 84-1234, 51 Fed Reg. 37398 (October 22, 1986; and the *Notice of Proposed Rule Mak-*

ing in General Docket No. 85-172, 50 Fed. Reg. 25587 (June 20, 1985), proposing further sharing of the UHF television band by private land mobile radio services.

[11] An allocation of 2 megahertz to the land mobile service with channels of 5 kHz bandwidth would provide 200 channel pairs. Spectrum-efficient technologies that use alternative bandwidths may also be considered.

[12] Service rules for the secondary land mobile allocation have been developed but service rules have not been developed for secondary fixed and aeronautical telemetry operations.

[13] While a number of commenters discussed the issue of interference to TV channel 13 from land mobile service in the 216-220 MHz band, none provided any technical analysis showing how this band may be used by land mobile for base/mobile operations on a primary basis without causing interference to broadcast operations. LAOAD stated in its comments that it will be performing some field tests on this issue and will provide the data and its findings from the tests for the public record. Land mobile operation currently exists in a number of frequency bands that are adjacent to TV broadcast channels. In order to avoid interference to TV broadcasting, land mobile operations are subject to compliance with technical standards and operational constraints in the FCC Rules. These vary according to the bands involved. We make no finding here as to what standards may be appropriate if we were to permit land mobile operation in the 216-220 MHz band. However, because TV channel 13 is used widely throughout the country, it appears that the necessary interference protection criteria and operational constraints would restrict the usefulness of the 216-220 MHz band for land mobile service.

[14] In addition to base/mobile repeater operations this band is used for remote control and experimental operations such as packet radio and moon bounce communications.

[15] See the *Repeater Directory* 1985-86 edition published by the American Radio Relay League. Repeater stations are not licensed separately and the Commission has no independent listing of repeater operations. Therefore, the *Repeater Directory* is the Commission's best source of information regarding loading in the amateur repeater bands. Nevertheless, we believe this to be an accurate representation of repeater operations since repeaters not listed in the *Repeater Directory* have no status in the coordination of new operations. As additional evidence of light loading in the 220-225 MHz band, we note that ARRL filed a petition, RM-5038, which requested that the 220 MHz band, among others, be made available for Novice operator licensees. ARRL made the request in part because of the "relative absence of General, Advanced, and Extra class operations on those frequencies..." *See* Petition for Rule Making, RM-5038, at 8. *See* also *Notice of Proposed Rule Making* in PR Docket No. 86-161, *In the* Matter of Amendment of the Amateur Rules to expand Privileges to Novice Operators, 51 Fed. Reg. 17074 (May 8, 1986).

[16] Supra, n. 2.